MARCH
1961

FOUNDRY

A PENTON PUBLICATION

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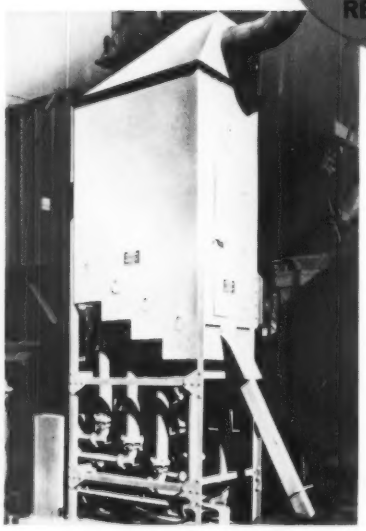
In 10 years, National has brought sand reclamation of age.

Every day thousands of dollars are being saved in our foundry industry.

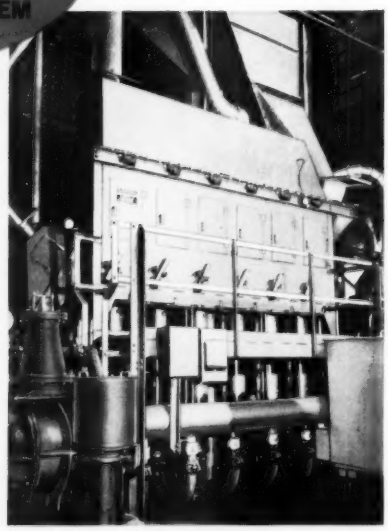
...because 70 National units are in use.

Your 1961 National system will come complete with classifier, rotary screen and individual cell controls.

NATIONAL
EVEN-FLO
RECLAIMING SYSTEM



1951: A Sand Scrubber unit



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Foundrymen who are aggressively waging the battle of profit vs. cost are winning with the National System.

There is a unit near you . . . Ask your National agent to show it to you . . . Write for literature.

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Circle 551 on Page 39

ONLY FROM REYNOLDS...

TENS 50®

with the HIGHEST STRENGTH/WEIGHT RATIO OF ANY ALUMINUM CASTING ALLOY

Check these characteristics of TENS 50 (named for its ultimate strength of 50,000 PSI) against your casting requirements:

- **Highest strength to weight ratio of any aluminum casting alloy for sand, permanent mold or investment casting.**
- **Properties comparable to medium strength aluminum forgings.**
- **Outstanding corrosion resistance.**
- **Easy to weld.**
- **Excellent fluidity and castability—not "hot short".**
- **Requires no changes in conventional melting, casting, gating, and heat treating practices.**
- **Complete scrap utilization—gates, riser and scrap castings can be remelted.**

Typical Sand and Permanent Mold "T6" Heat Treatment Properties		
	Sand	Permanent Mold
Tensile Strength	47,000	53,000
*Yield Strength	38,000	43,000
Elongation	4%	7%

*Engineers: Note outstanding yield strength.

Reynolds Metals Company and their Distributors are the only source for TENS 50. For complete information on this strong and ductile aluminum casting alloy, write for TENS 50 brochure to *Reynolds Metals Company, P. O. Box 2346-FK, Richmond 18, Virginia.*

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When it's TOO HOT for ordinary washes ...use VELVALITE ZA-2

Pouring steel at 3000 degrees or more? One wash stands up against it–VELVALITE ZA-2. The "Z" stands for Zircon–a refractory that won't erode or burn away, even inside heavy sections, gates, sprues and runners. Alcohol is the suspension agent, permitting light-off on resin bonded, shell, air-cured, and other no-bake cores.

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Why the name VELVA? Because castings come out with velvet-smooth finishes ready to please your toughest customer. Contact your ADM-MAN today.

Write for your copy of ADM's Core Wash Specification Chart

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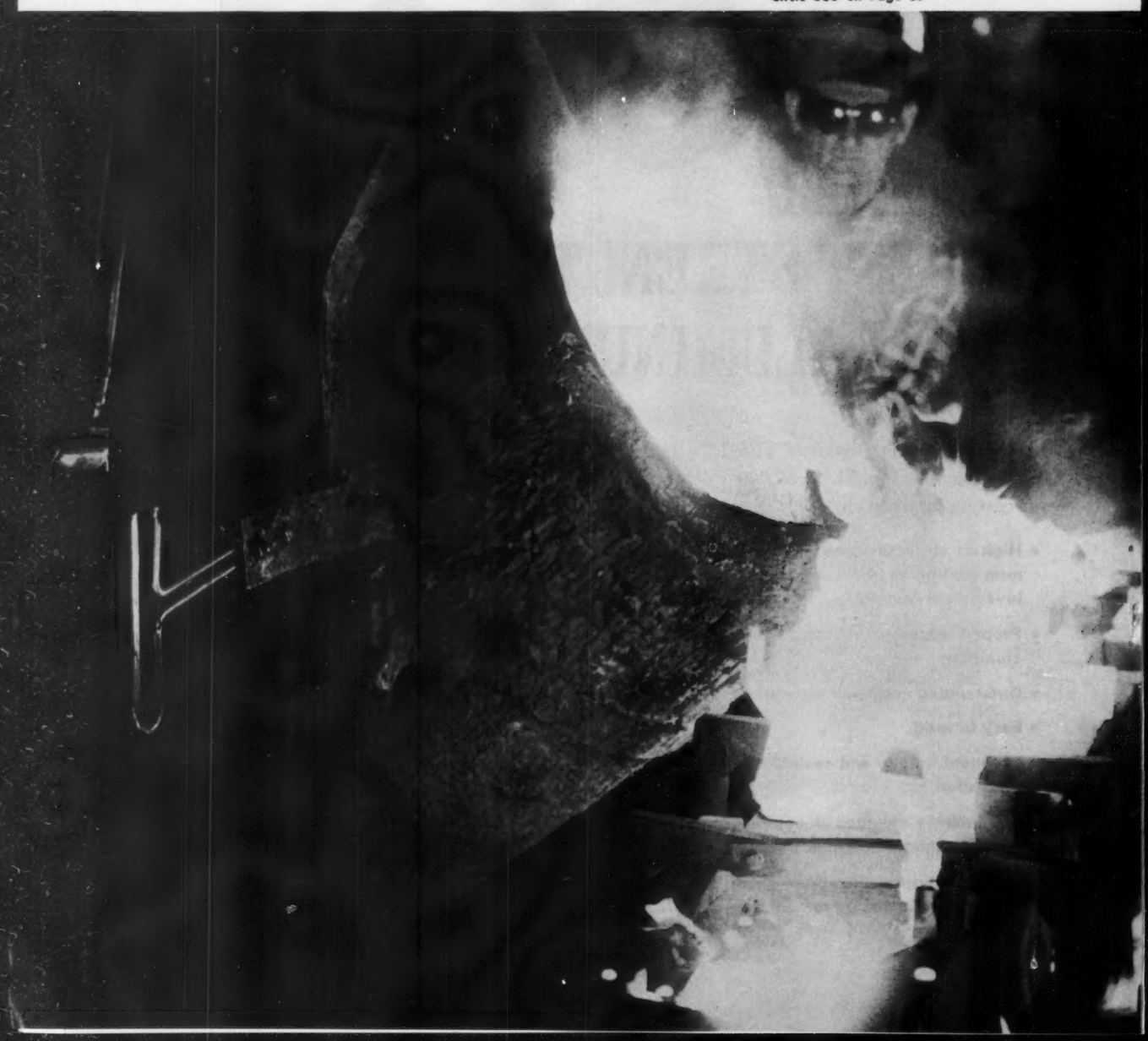

March 1961
Volume 89—Number 3

FOUNDRY
A PENTON PUBLICATION

It could pass for a chandelier, but actually this full-ring riser and arbor make up the cope half of a mold. Bethlehem Steel Co. employed such molds in casting manganese-bronze impellers. See Page 134 for details.

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FOUNDRY is edited primarily for management, production, technical, and purchasing personnel in foundries. A copy is sent at no cost to each metal casting plant in the U. S. and Canada employing 20 or more workers and to selected smaller foundries. Additional copies are sent to each foundry to the extent necessary to serve all key foundry personnel on a personal or routed basis. A limited number of copies is supplied at no cost to educational institutions. Subscriptions in the U. S., possessions, and Canada for home-addressed copies and copies not qualified for under the above principles: One year, $10. Single copy, $1. Other countries: One year, $20. Single copy, $2. Published monthly by The Penton Publishing Co., Penton Building, Cleveland 13, Ohio. Accepted as controlled circulation publication at Cleveland, Ohio.

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THE EDITORS' WORKSHOP

ESTIMATING: One of the tough problems in developing accurate cost figures in the jobbing foundry is the estimating of manhour requirements for a scheduled load. Because such estimates frequently show large errors, attempts have been made to develop improved methods. One successful method will be described in our April issue. The article, "An Improved Method for Foundry Estimating," was prepared by Gary G. Stone, Pacific Gas & Electric Co., and Prof. E. Paul DeGarmo, University of California.

HIGH SPEED: Ford Motor Co. uses a highly mechanized casting operation in producing exhaust valves at a rate of 9600 an hour. The nickel-

chromium steel valves are cast in shell molds at the Dearborn Specialty Foundry. Definning the gate core, unloading core and mold machines, mold assembly, and pouring are the only steps involving hand labor. See next month's issue for a detailed description of the operation.

COMING: Other exclusive articles to look for in coming months will discuss air conveyors for foundry sand, the economical use of brass foundry metal, and some useful techniques for calculating casting weights. Our series of articles on gating and risering takes up investment castings next month.

Diecasters will be interested in an article telling how Europe's largest zinc diecaster, Wolverhampton Die Casting Co. Ltd., achieves flexibility in jobbing operations. The author is the international authority Hiram Barton.

Circle 556 on Page 39→

NOW MORE PROFITABLE COREMAKING...with

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Completely self-curing foundry resin that "BAKES" AT ROOM TEMPERATURE

FACT: YOU CANNOT OVERBAKE A CHEM-REZ A-200 CORE

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Resulting from NO-BAKING:

- ☐ Convert oven space into useful coremaking space.
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- ☐ Run emergency jobs in one day. Relieve scheduling of work. Reduce time between core fabrication and casting.
- ☐ Eliminate core scrap due to baking.

See how CHEM-REZ A-200 can change COREMAKING TO PROFITMAKING

Here are some profitable ideas which can be employed through the use of CHEM-REZ A-200. Why not check the ideas which will increase profit in your foundry? Then call your ADM-MAN for a demonstration.

CHEM-REZ PROFITMAKER #2

Resulting from RELIABLE, COMPLETE CURING BY CHEMICAL REACTION:

- ☐ Reduce scrap cores caused by insufficient cured strength.
- ☐ Increase rate of turnover of active core boxes.
- ☐ Eliminate compressed air for curing. (Air accelerates cure only by helping remove the water formed by the resin reaction.)
- ☐ Convert storage space required for rammed up cores "waiting in line" for oven room into useful coremaking space.

CHEM-REZ PROFITMAKER #3

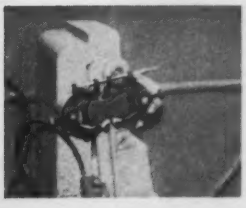
Resulting from HARD SURFACE CORES:

- ☐ Paste core assemblies and/or apply mold washes immediately upon drawing core from box.

*In Canada, manufactured and sold under the trade-name LIN-O-SET A-200.

CHEM-REZ PROFITMAKER #4

Resulting from HIGH TENSILE STRENGTH:



- ☐ Reduce, in part, the use of rods and wires.
- ☐ Save roll over; draw core from box, not box from core.
- ☐ Use adaptable CHEM-REZ A-200 for dry sand mold facing applications with any fairly dry heap sand as back up.

Archer QUALITY

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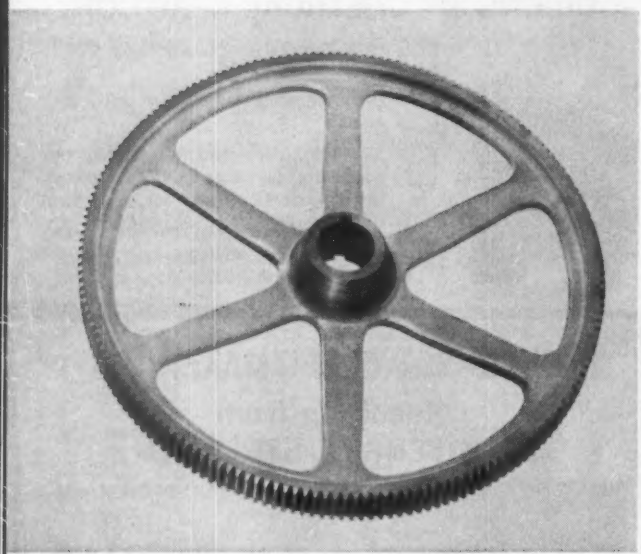
Republic Malleable Pig Iron Helps Loom Maker Weave Pattern of Success

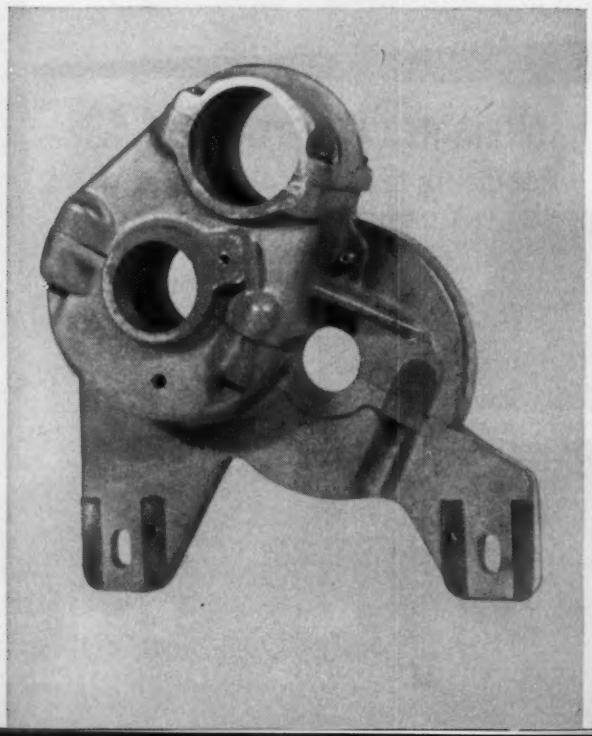
When Draper Corporation's popular, new shuttleless loom goes into action, cast parts operate in precise relationship to each other with the accuracy of a fine watch. Loom design must provide both strength and extreme accuracy.

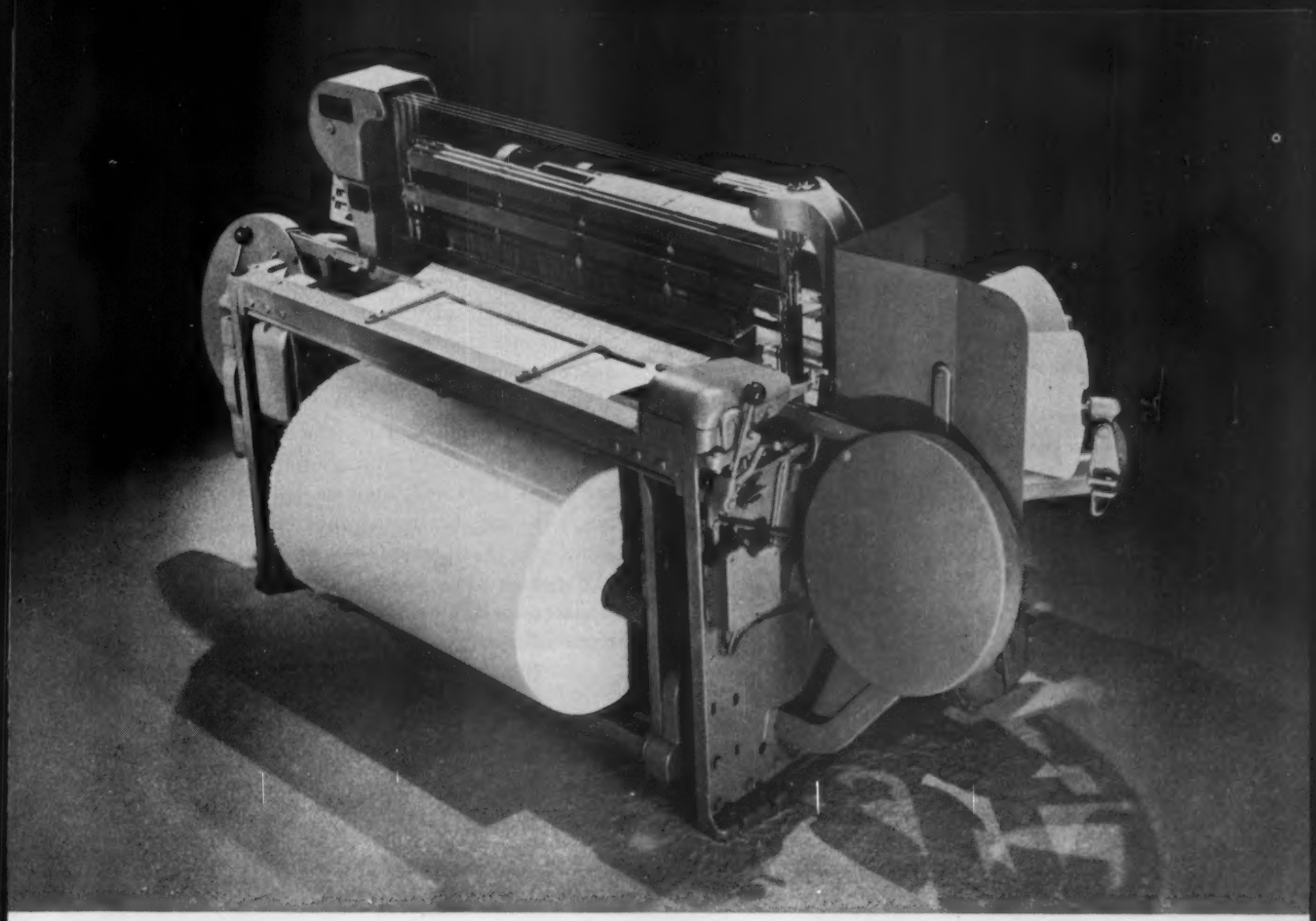
For these reasons, Draper uses only the highest quality raw materials, including Republic Malleable Pig Iron, in casting precision loom parts. And, to maintain absolute quality control, the company operates its own foundries at Hopedale, Mass. and Spartanburg, S. C. They have found that Republic Malleable Pig Iron provides the strength and machinability required for the production of extremely accurate castings.

Draper, like thousands of other customers, relies on the uniform chemistry and consistent high quality of Republic Pig Iron to produce strong, flaw-free, economical and easy-to-machine castings. Consider these advantages in terms of your own production . . . then contact your Republic representative, or mail the coupon for more information.



Transmitter gear and harness change gear case are two of many precision castings produced from Republic Malleable Pig Iron by Draper Corporation for the shuttleless loom.





COMPLETE FOUNDRY ENGINEERING SERVICE is available without obligation to all foundries. Republic Foundry Service Engineers are thoroughly qualified to assist you in every department of your foundry operation. They recommend, from industry's most complete line of merchant pig iron, the grade best suited to your requirement, your equipment, your specification. Northern grades include Chateaugay, Foundry, Malleable, Bessemer, and Basic. Southern furnaces produce Malleable, Foundry, and Basic.

For ideas on increasing the use and sale of castings . . . for suggestions on increasing production efficiency . . . for information on the latest foundry processes and techniques, mail the coupon for a call by a Republic Foundry Service Engineer.

Circle 557 on Page 39

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Similar to Mulram E but supplied in finer grain.

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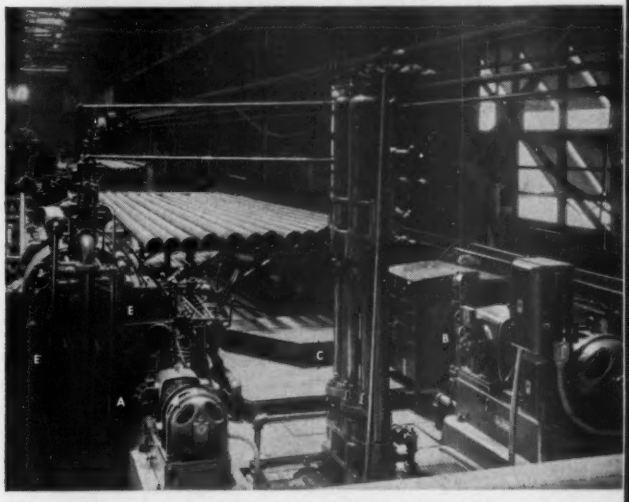
...Fluid Power news

OILGEAR 40 Years of Fluid Power

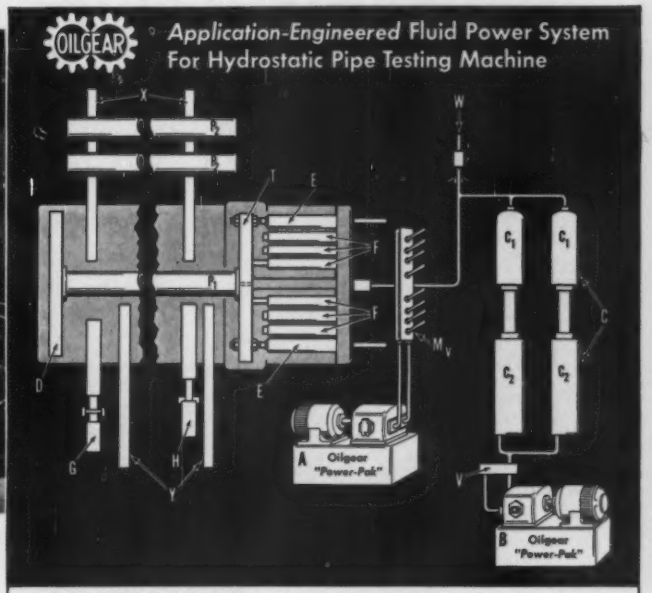
From Oilgear *Application-Engineering* Files

HOW OILGEAR SYSTEM POWERS PIPE TESTER EFFICIENTLY AFTER 23 TROUBLE-FREE YEARS

DATA: To supply power and control system for five functions of a hydrostatic pipe testing machine designed for a wide variety of pipe sizes and testing pressures ranging up to 6000 psi. Linear drives and controls were needed to: *1.* Actuate jaw-type clamps to hold and prevent pipe from buckling. *2.* Traverse testing head rapidly to and from testing position. *3.* Hold testing head against pipe under testing pressures. *4.* Actuate "knockout" arms to eject tested pipe from machine. *5.* Actuate an intensifier to boost water used for testing from city pressure to any selected testing pressure up to 6000 psi. *Specific Operating Requirements:* Simple, safe, dependable; capable of continuous, 'round-the-clock operation, 6 days per week in highly humid atmosphere; cycle rapidly for economical production; require a minimum of maintenance to prevent costly, line-stopping downtime; must be compact to conserve valuable floor space, economical in the use of electrical power.



Hydrostatic Pipe Tester with *Oilgear Application-Engineered Fluid Power System* as installed in 1937, and operating continuously since that time. Oilgear "Power-Paks" (A,B), Intensifier (C), Rapid Traverse Testing Head Cylinders (E) are indicated by arrows. Manifold and Control Valves at operator's station (M_V in drawing) are clearly visible, as are the direct-reading, operating pressure gages on the "Power-Paks." Testing pressures are quickly preset with a small handwheel on "Power-Pak" (B)—not visible. Pipe to be tested rolls directly from pre-testing storage racks, at right, directly into the machine.



HOW IT WORKS: Pipe to be tested (P_2) rolls from storage rack (X) into cradle of machine between Testing Head (T) and Tail Carriage (D). Testing Head (T) is moved forward quickly by Double-Acting Cylinders (E). Clamping Jaws actuated by Cylinder (G) grip the pipe along its length to prevent buckling. Pipe (P_1) is pre-filled with water at city pressure (W). Single-Acting Test Head Holding Cylinders (F) move up in matching pairs—2, 4, 6, 8, 10, or all 12 can be selected—depending on pipe size and testing pressure to hold Testing Head (T) against Pipe (P_1) and Tail Carriage (D). Movement of cylinders (E, F, G, H) are all controlled by valves mounted on Manifold (M_V) which direct fluid flow from Oilgear "Power-Pak" (A). Water at preselected test pressure from Intensifier (C) then exerts pressure on Pipe (P_1). Oilgear "Power-Pak" (B) supplies *Fluid Power* through Valve (V) to actuate Hydraulic Intensifier Cylinders (C_2) increasing pressure in Water Cylinders (C_1) to any desired pressure up to 6000 psi. After pipe is inspected, intensifier pressure is released, Testing Head (T) is rapidly retracted, and Knockout Cylinder (H) actuates mechanism to eject tested pipe onto rack (Y). Machine is then ready to start a new test cycle.

SOLUTION: An *Oilgear Application-Engineered System* consisting of two Oilgear Heavy-Duty "*Power-Paks*," Directional Control Valves, and "Custom-Quality" Cylinders. Each "*Power-Pak*" uses an Oilgear Heavy-Duty One-Way Variable Displacement Radial Rolling Piston Pump with automatic pressure unloading control to reduce pump stroke when holding a preset pressure indefinitely; eliminate excessive heating and power loss; reduce electrical power input requirements. Oilgear Pumps contain integral auxiliary systems for pilot, supercharge, cooling and filtering . . . with constant pressure and flood self-lubrication, conservatively loaded anti-friction bearings, and large internal passages—mechanical and hydraulic friction is reduced to a minimum for high efficiency . . . virtually guaranteeing a long, trouble-free, maintenance-free life.

USER REPORTED IN 1938—"*. . . after one year of operation we have nothing but the highest praise for the Oilgear Equipment on this pipe tester.*"

USER REPORTS IN 1960—"*This machine has given us years of trouble-free service, operating around the clock six days a week . . . maintenance has been at a minimum, with occasional changes in intensifier packings, as would be expected in normal operation . . . performance has been completely satisfactory.*"

Circle 559 on Page 39

With Oilgear Heavy-Duty System Components designed for thousands of hours of continuous service at full rated load, savings are compounded with every hour of uninterrupted performance. That's why machinery and equipment manufacturers and *their* customers say . . .
"For the lowest cost per year . . . it's Oilgear!"

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REVERABLE: Dip-out furnace for yellow metal and aluminum permanent mold casting. Non-crucible. Sizes: 300 lbs. to 900 lbs. per hour.

Canadian Representative: Drew Brown Ltd. 5410 Ferrier St., Montreal 9

Circle 560 on Page 39

With the EDITORS

You Should Be There: The 14th annual College-Industry Conference of the Foundry Educational Foundation will be held at the Statler-Hilton Hotel, Cleveland, April 19-20.

It has been the good fortune of one or more of the editors of FOUNDRY to attend each of the previous conferences. In their opinion, the programs presented each year have been outstanding, with real worth for everybody.

This year should be no exception. The entire program will be presented by young men who formerly were FEF students and who now hold responsible positions in the foundry industry.

Each year attendance of college and university representatives has been exceptionally good. Industry has not done as well.

You can gain much for the further progress of your company and provide much satisfaction for yourself by attending the 1961 meeting, listening to an exceptional program, meeting and discussing problems with the college representatives and the former students, and by adding strength to the remarkable work done by FEF.

I hope to see you there.

A Celebration: The accompanying illustration shows two important men in the steel foundry industry mapping plans and activities for the centennial year for steel castings. On the left is George K. Dreher, marketing director, and on the right F. Kermit Donaldson, executive vice president, Steel Founders' Society of America.

The illustration is presented to call special attention to our cover, which features the emblem of the centennial year, and to suggest that you will find the anniversary article on steel castings, starting on page 102 of this issue, most interesting.

The illustration also is presented to show what may be found on the desk of important men in the steel casting industry, or for that matter any part of the foundry industry.

The photograph, from which our illustration was made, was part of a press kit distributed to the members of the Fourth Estate attending the meeting of the Newcomen

Society at the Franklin Institute in Philadelphia on Jan. 19, where the steel casting industry and the SFSA president, Wilson H. Moriarty, National Malleable & Steel Castings Co., Cleveland, were honored by the society.

Challenge Continued: Last month this column presented the first of two editorials from our English contemporary, the *Foundry Trade Journal*, written by Dr. J. G. Pearce, retired director of the British Cast Iron Research Association. The second and concluding portion, presented in the Oct. 6, 1960 issue of that publication, under the heading "The Challenge II" is as follows:

As soon as the need for castings beyond the possibilities of the then USSR production was realized, Prof. Nekhendzi's paper says "from that time on, scientific work and investigations were conducted in all fields of foundry production, from the theory of foundry processes to the development of computation techniques for special foundry equipment and automatic devices, organization and protection measures of labour."

These investigations were often conducted by groups of specialists in different fields. Facilities evidently exist on a large scale for experimental work on cast metals, foundry materials, processes and equipment. The output of spheroidal-graphite iron castings is said to have

INCREASED SPALLING RESISTANCE

VEGA HP
STAR DASH
CONVENTIONAL SILICA BRICK
Heated at rates which break up conventional silica brick, VEGA HP and STAR DASH show no evidence of cracking or spalling.

DEMONSTRATED BY HARBISON-WALKER SILICA REFRACTORIES

The results of these tests indicate a most important advance in the properties of silica refractories. Here are two examples of actual performance.

VEGA HP In one open hearth shop, average roof life was increased from 100 to 250 heats by using VEGA HP. The optimum combination of highest refractoriness and spalling resistance resulted in maximum service life.

STAR DASH In a steel foundry electric furnace roof, STAR DASH was used in a lining that lasted 152 heats compared with a previous average roof life of from 75 to 100 heats. This increase in service life is attributed to improved spalling resistance.

The high spalling resistance of these specialized brands suggests other uses—such as in glass plants, tunnel kilns, copper anode furnaces, acid-operated iron cupolas, carbon baking furnaces, heating furnace roofs, and soaking pits. Write for details.

HARBISON-WALKER REFRACTORIES CO.
AND SUBSIDIARIES
GENERAL OFFICES: PITTSBURGH 22, PENNA.
World's Most Complete Refractories Service

HW-61-4

Circle 561 on Page 39

Largest Merchant Iron Producer in U. S. Chooses

WHIRLEX ID FANS

High Erosion Resistant Fan Wheel Assures Longer Life... Minimum Maintenance

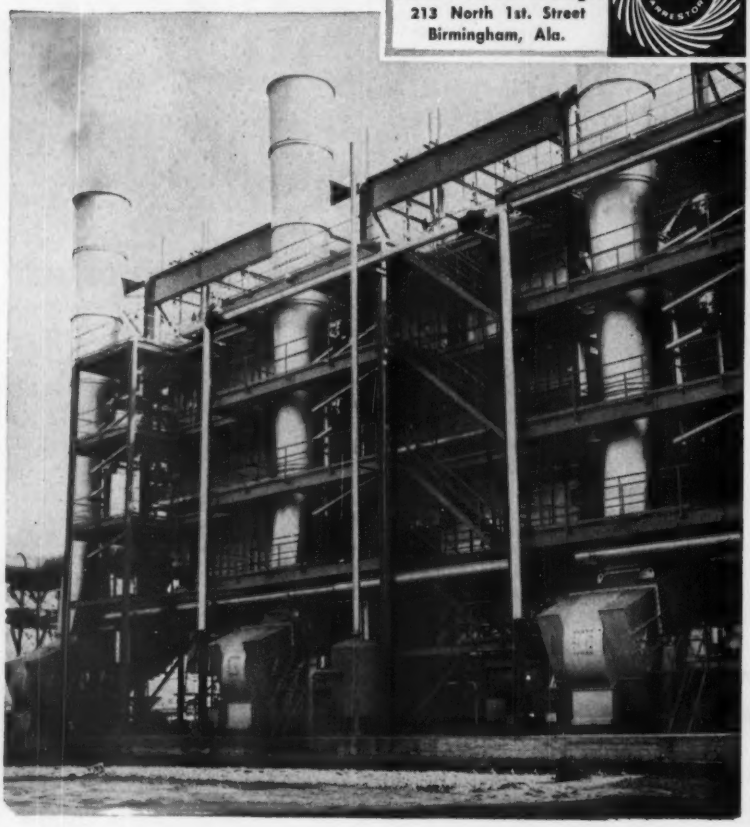
The largest furnace in the country producing merchant pig iron was recently placed in service as part of an expansion program by a major Southern mill. The new furnace has a rated capacity of 1000 tons per day and is one of the most modern in the country with respect to mechanization and automatic controls.

Because of their unique design and high erosive resistance, WHIRLEX heavy duty induced draft fans were chosen to handle the hot blast furnace gas. The three units shown here carry approximately 150,000 cubic feet of gas per minute. Preliminary fan examinations show wear to be less than a third that of ordinary fans designed for this purpose.

A Whirlex fan installation may solve your problem. Write or wire us.

Fly Ash Arrestor Corp.
213 North 1st. Street
Birmingham, Ala.

WHIRLEX



reached 250,000 tons per annum, up to individual weights of 35 tons and strengths of 50 tons per sq in. tensile; the importance of design in relation to cost, mode of manufacture and service life is fully recognized.

Soviet foundry production appears to be tending more and more to concentration in specialized foundries, permitting complex mechanization and automation. During the next seven years, the total number of foundries will be reduced by one-fifth, as a result of eliminating small foundries with relatively high labor costs, but the average production of iron and steel castings per foundry will be approximately doubled. By eliminating weight variations in castings of the same design, it is expected that from one-half to one million tons of metal will be saved in the USSR by 1965. Machining allowances are being reduced from 13 to 14 per cent at present to 7 to 10 per cent by the same date.

What educational measures are operated by the Soviet to make this possible? There are Chairs of foundry production at higher educational institutions and laboratories at the large plants and at various engineering and metallurgical research institutes. These employ graduate scientists and engineers, and 1500 to 2000 foundry engineers graduate from the higher institutions every year. It is difficult to make direct comparisons with this country, but foundrymen receive their training at day, evening, or correspondence-course institutes. The day institutes are doubtless full time and at some, instruction is on a physico-chemical/metallurgical engineering basis, for men qualifying as foundry specialists. At others, it is on a mechanical-engineering basis, for graduates specializing in the design and application of foundry equipment.

In 1959, the day institutes of the former type produced 750 students and a similar number from the latter type, making 1500 in all, with 260 from the other sources. Thus, a total of about 6750 Russian student foundry engineers are being trained at day institutes, plus 3200 from the other two sources, making nearly 10,000 in all. Close unity of science and practice is maintained during training.

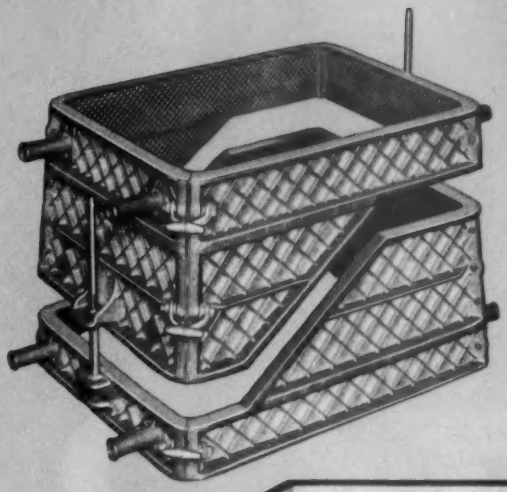
Allowing for population differences for foundry engineers and metallurgists, the output rate is something like seven or eight times that of the UK, which country, however, does not produce foundry specialists at graduate level, although some graduates in engineering and metallurgy do find their way into the foundry industry.

For May: The editors have an exceptionally fine survey of technical progress in the foundry industries scheduled for the May, pre-convention issue. Watch for it.

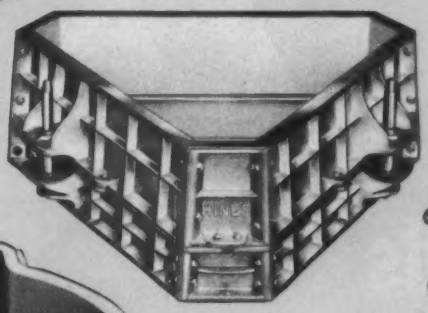
F.G.S.

Circle 562 on Page 39

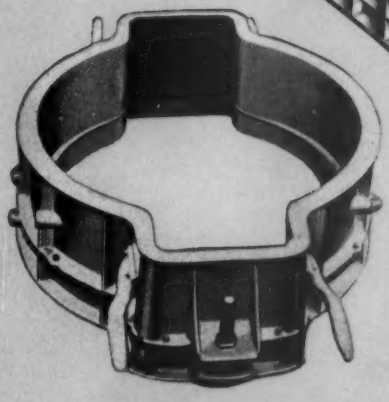
HINES SPECIAL FLASKS



• Shown here are but a few of the many special flasks designed and fabricated by HINES to do difficult molding jobs more efficiently. In many cases, HINES has been able to design flasks for making castings previously considered impractical, if not impossible to produce. Many of these special flasks incorporate the familiar HINES "POP-OFF" corner release mechanism, to further speed up production, increase accuracy of the mold and prolong flask life.



"POP-OFF"—®

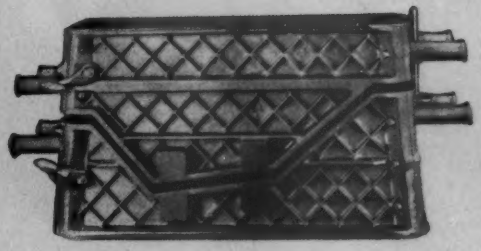


It's entirely possible that a HINES "special" may be the answer to that difficult molding problem now confronting you. Our engineering department will gladly submit recommendations. A phone call, wire or letter will put them on the job at once.

THE HINES FLASK CO.

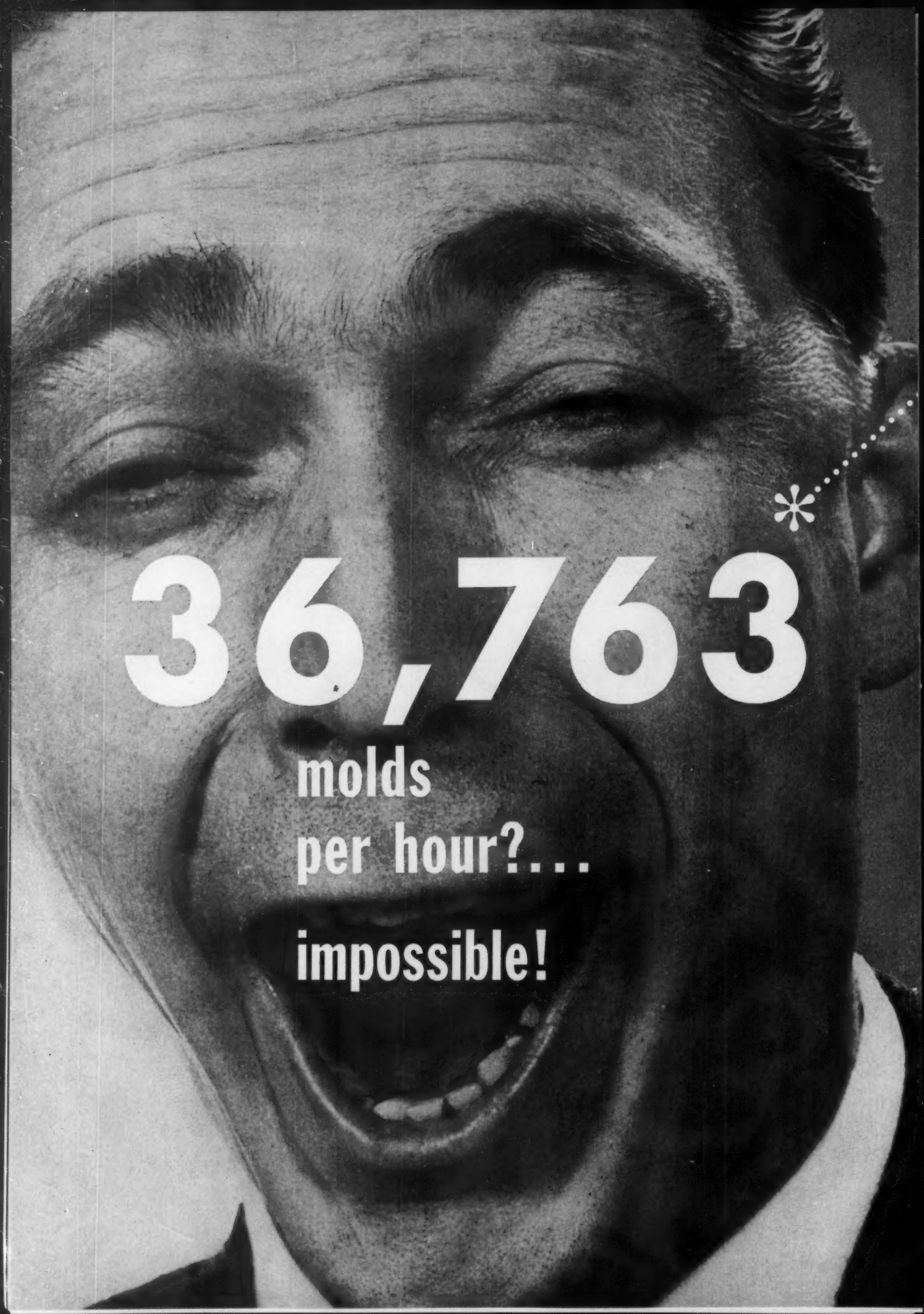
3431 WEST 140th STREET • CLEVELAND 11, OHIO

ORchard 1-2806



HINES FLASKS

Circle 563 on Page 39

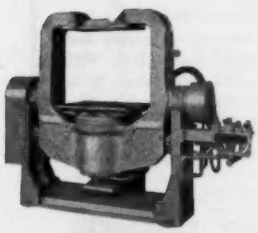

36,763*
molds
per hour?...
impossible!

* THE FIGURE IS RIGHT...

AND ACTUALLY QUITE CONSERVATIVE!

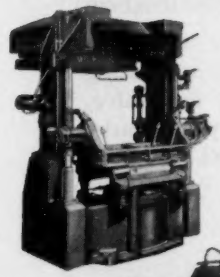
The identification trade mark of SPO states that this organization is the "World's largest supplier of mold-machines." This is not just another advertising claim. There are SPO machines operating all over our globe . . . in almost every country. At this moment, men of every race, creed and color . . . and speaking virtually every language and dialect in the world . . . are producing molds on machines bearing the name SPO. It is our conservative estimate that MORE than 36,763 molds will be produced in THIS hour.

Our leadership has been earned . . . earned through long years of devotion to the industry and applied skill within individual professions comprising the entire field of metals. In foundry molding systems, our technological advances resulting from creative engineering, have established new horizons of molding progress.

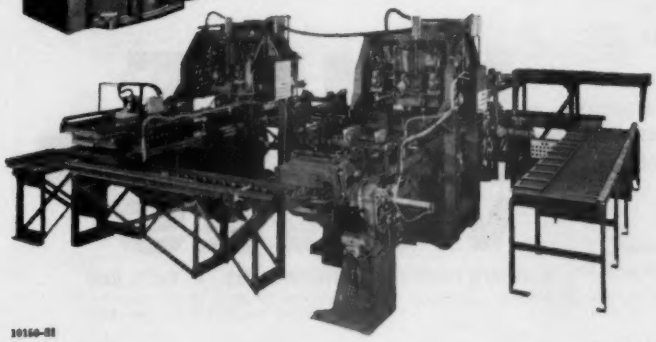


SPO leadership will not go unchallenged . . . however . . . we propose to continue our dedication to progress. We will continue to improve our creative engineering services so that we can continue to supply versatile, efficient, economical "packaged" systems to meet every molding requirement, including Turnkey facilities.

THERE'S A SPO MACHINE FOR EVERY MOLDING JOB



In an industry as specialized as the foundry, leadership cannot be assumed . . . it must be earned through capability and accomplishment.



WORLD'S LARGEST SUPPLIERS SPO OF MOLDING MACHINES

SPO INCORPORATED

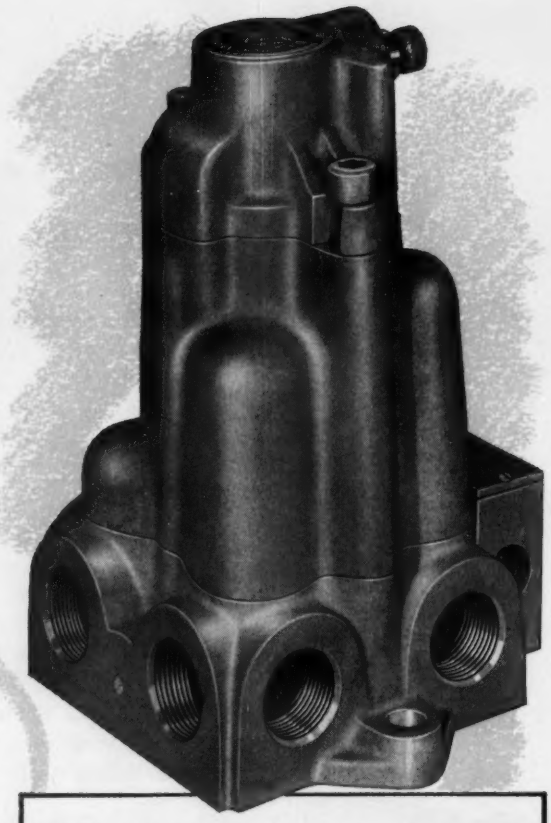
6449 Grand Division Ave.,
Cleveland 25, Ohio

10160-BI

Circle 564 on Page 39

It's new! HUNT ONE INCH PDQ VALVE

TOPS in accessibility
TOPS in simplicity
TOPS in speed
TOPS in capacity
TOPS in quality



Cylinder ports front, side and bottom-tapped; supply and exhaust ports side and bottom-tapped; basic 1 in. PDQ available tapped ¾, 1 or 1¼ in. NPT (also basic ½ in. PDQ tapped ⅜, ½ or ¾ in. NPT); for air or vacuum service, pressures from 0 to 125 psig; meets JIC Standards.

Now you can have all the performance-proved advantages of Hunt's PDQ center-line design PLUS the high capacity of full 1" size. The PDQ's short stroke pilot and compact, lightweight, single spindle poppet provide lightning-fast response and near-instantaneous full flow. All this in a compact package weighing only 10.8 pounds!

Look at these performance figures. The 1" PDQ, with 100 psig supply, fills a 400 cu. in. vessel to 90 psig in but 0.288 seconds (17.3 electrical cycles) . . . exhausts the same vessel from 100 to 10 psig in 0.200 seconds (12 electrical cycles) and, at 100 psig, its flow capacity is 850 cfm free air!

Downtime? Short stroke, shock-reducing all-aluminum construction and built-in wear compensation assure millions of cycles of trouble-free operation. Then, to repack, simply loosen 2 cap screws . . . twist pilot cap . . . remove pilot and valve housing. Piping is undisturbed . . . electrical connections are plug-in, wiring need not be touched.

If you're looking for better, lower cost, more dependable performance on new or existing equipment . . . before you buy any valve, be sure you see the PDQ. Call your nearby Hunt Representative today. He's listed in Sweet's Product Design File.

For more information, write for Bulletin 602. Address Dept. FO-361, Hunt Valve Company, Salem, Ohio.

HUNT

QUICK-AS-WINK® AIR AND HYDRAULIC

VALVES

HUNT VALVE COMPANY • DIVISION OF IBEC • SALEM, OHIO

3010

LATE NEWS

RECOVERY: Business recovery should begin within a few months, and the current recession should prove to be relatively short and mild. That's the indication of the latest Monthly Change Indices prepared for the National Association of Purchasing Agents by Dr. John H. Hoagland, Michigan State University. These indices are developed from business surveys of purchasing executives and have proved consistently reliable in forecasting turns in business cycles.

$100,000 GIFT: A permanent chair of metallurgical engineering honoring Peter E. Rentschler, president, Hamilton Foundry Inc., Hamilton, Ohio, has been established at the University of Cincinnati. It was made possible through the gift of stock valued at $103,105.02 from two foundations, the Hamilton Foundry Inc. Foundation and the Decatur Casting Co. Dr. Roy O. McDuffie, veteran member of the university's Engineering College, has been appointed the first Peter E. Rentschler professor of metallurgical engineering. Mr. Rentschler also donated $15,000 to the university in 1957 to aid in the teaching of metallurgical engineering.

DIECASTING PLANT: Harvill Corp., Los Angeles, has begun construction of a $1.3 million, 101,000-sq-ft manufacturing facility which will increase its production capacity by more than a third. Designed for the manufacture of diecastings and molded plastic products, the plant will be situated in the Rancho San Pedro Industrial Area, near Compton, Calif. It is sched-

Foundry Statistics

Iron and Steel Scrap Consumption

(Gross tons*)

	All Scrap Total	By Types of Furnace — Cupola Total	Air Total	Electric Total
1958	50,242,746	7,725,970	821,388	7,152,726
1959				
Oct.	2,266,709	798,569	98,279	445,137
10 mo.	47,161,115	8,115,786	953,736	7,422,324
Nov.	4,796,896	614,233	82,784	801,555
Dec.	7,021,870	843,040	99,577	1,008,158
Total	58,979,881	9,613,059	1,156,097	9,232,037
1960				
Jan.	7,043,488	823,442	95,442	1,058,159
Feb.	6,493,558	822,476	97,688	1,015,716
Mar.	6,655,569	839,016	106,749	974,535
Apr.	5,625,717	754,486	82,767	787,186
May	5,051,121	771,800	79,170	652,585
June	4,485,444	809,297	87,455	633,797
July	3,678,127	603,062	55,974	520,361
Aug.	4,217,562	692,470	78,788	697,243
Sept.	4,148,550	732,252	76,939	641,712
Oct.	4,375,871	742,039	71,862	675,356
10 mo.	51,775,007	7,590,340	852,864	7,956,650

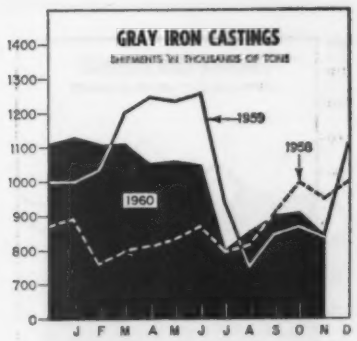
Index of Foundry Equipment Orders

Foundry Trades Only
(Net Orders Closed, New Equipment)

	1959	1960
Jan.	127.4	95.5
Feb.	237.1	123.6
Mar.	166.6	159.9
Apr.	154.2	97.9
May	157.0	159.0
June	125.1	164.3
July	110.7	80.0
Aug.	134.1	92.4
Sept.	131.3	155.1
Oct.	140.8	81.7
Nov.	131.2	106.5
Dec.	95.9	101.2

Note: Base period 1947-49 taken as 100 per cent monthly average.

Source: Foundry Equipment Manufacturers Association.



GRAY IRON CASTINGS—SHIPMENTS

(Net tons[1])

	All Castings Total	All Castings For Sale	Miscellaneous Castings Total	Miscellaneous Castings For Sale	Nodular Iron Castings Total	Heavy Steel Ingot Molds Total	Chilled Railroad Car Wheels Total	Pressure Pipe & Fittings Total[2]	Soil Pipe & Fittings Total[2]	Unfilled Orders[3]
1958	10,357,504	5,849,426	6,146,136	2,648,995	117,558	1,884,396	265,114	1,277,685	784,123	.....
1959										
Nov.	830,743	515,270	493,125	249,958	13,061	165,139	16,723	96,086	59,670	885,657
11 mo.	11,200,266	6,409,895	6,801,989	2,976,379	155,658	1,848,369	289,350	1,348,744	811,814	.....
Dec.	1,106,796	583,571	649,200	270,276	14,651	294,129	20,595	92,139	50,733	845,575
Totals	12,307,062	6,993,466	7,451,189	3,246,655	170,309	2,142,498	309,945	1,440,883	862,547	.....
1960										
Jan.	1,135,575	591,804	677,392	277,100	16,774	295,994	13,463	86,798	56,928	851,336
Feb.	1,107,721	571,143	678,927	279,190	16,430	284,738	17,848	76,332	49,876	855,324
Mar.	1,143,395	600,162	685,102	284,207	15,670	294,322	24,409	83,121	56,441	880,132
Apr.	1,051,357	580,590	609,234	258,994	13,980	232,895	21,737	118,886	68,605	834,495
May	1,052,798	588,770	613,745	257,180	13,126	207,094	20,414	136,455	75,090	781,596
June	1,049,638	601,597	622,236	273,148	15,010	183,049	19,810	144,773	79,770	719,564
July	803,306	450,580	478,269	202,347	10,694	120,784	16,226	120,652	67,375	754,789
Aug.	858,503	540,395	490,059	238,561	15,675	131,428	14,221	139,275	83,520	712,784
Sept.	909,497	527,227	554,788	245,887	14,616	125,688	13,460	135,327	71,234	695,325
Oct.	905,139	500,054	568,869	238,249	12,859	139,977	12,559	117,009	66,725	646,852
Nov.	835,709	454,611	538,817	230,022	11,870	123,054	12,310	102,959	58,469	568,974
11 mo.	10,843,638	6,006,933	6,517,438	2,784,885	156,704	2,138,923	191,457	1,261,587	734,033	.....

*Source: U. S. Dept. of Interior Bureau of Mines. [1]Source: Bureau of the Census. [2] For sale only. [3]All cast iron pipe is shipped for sale. [4]Gray iron total included nodular iron.

Late News

uled for occupancy in early July. Harvill will transfer all operations from its present location at 6251 W. Century Blvd. to the new location.

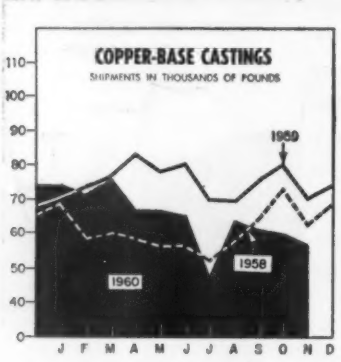
FELLOWSHIP WINNERS: Foundry Educational Foundation Board of Awards has announced the following 1961 winners of Wheelabrator Fellowships: Robert G. Chambers, Jonesboro, Ga., who will do graduate work at the University of Alabama; David B. Routledge, Lexington, Ky., University of Kentucky; William F. Stuhrke, Cleveland, Case Institute of Technology; Thomas H. Steffen, Chicago, University of Illinois.

ORDNANCE CASTINGS: Castings Section of the American Ordnance Association will hold its second annual Technical Meeting at the Detroit Arsenal on March 9-10. Although this is an AOA meeting, anyone interested in an industry-government exchange of information on castings techniques may register for the sessions. For an invitation, contact W. M. Dalton, secretary of the section, at Dalton Foundries Inc., Warsaw, Ind.

SAND SCHOOL: A sand school will be held in Winnipeg, Manitoba, Canada, March 7 and 8 for foundrymen in the area. It will be sponsored by Foundry Supply Co., Minneapolis.

PERSONALS: Benjamin S. Head has been appointed general superintendent, Defiance, Ohio, plant, Central Foundry Div., General Motors Corp. Donald R. Dunlap, formerly superintendent of the aluminum department at the Defiance plant, succeeds Mr. Head as production manager . . . Arwood Corp. has named Leland Hargraves and Fred W. Dischinger to be plant managers at its Los Angeles and Laverne, Calif., plants respectively. George Main has been appointed eastern division sales manager for the corporation . . . William H. Johnson has been named technical director, Centrifugal Casting Div., Shenango Furnace Co., Dover, Ohio . . . Leo Reierstad has been appointed general sales manager, Permanent Mold Die Co., Hazel Park, Mich., and its subsidiary companies, Piston Mold Die Co. and PMD Extrusion Die Co. . . . Harold L. Holtz has retired as vice president, Sivyer Steel Casting

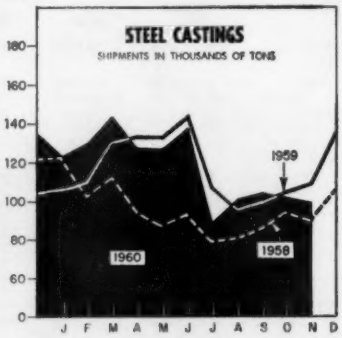
Foundry Statistics



COPPER-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments			
	Total	Sand	Perm. Mold	Unfilled Orders[2]
1958	762,484	697,360	31,854	.....
1959				
Nov.	55,255	50,094	4,840	29,147
11 mo.	799,952	703,064	48,170	.....
Dec.	71,110	62,182	4,286	29,243
Total	871,032	765,246	52,456	.....
1960				
Jan.	73,971	65,742	3,915	26,053
Feb.	71,797	63,103	4,146	26,970
Mar.	75,908	66,517	4,346	27,470
Apr.	66,777	58,453	4,523	27,423
May	66,299	57,848	4,463	24,582
June	64,585	56,441	3,715	21,781
July	48,399	42,778	2,910	22,367
Aug.	63,765	56,344	3,669	21,915
Sept.	61,362	54,104	3,699	21,063
Oct.	59,877	52,734	3,556	22,008
Nov.	56,347	50,032	3,132	21,253
11 mo.	706,087	624,096	42,174	.....



STEEL CASTINGS—SHIPMENTS

(Net tons[1])

	All Castings			Carbon			Alloy			
	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Unfilled Orders[2]
1958	1,121,000	856,986	149,644	801,846	606,240	136,251	319,154	250,746	13,393	.....
1959										
Nov.	109,460	86,026	11,764	77,320	59,294	10,799	32,140	26,732	965	301,858
11 mo.	1,279,539	1,008,530	192,116	943,895	736,702	177,001	335,644	271,828	15,115	.....
Dec.	133,346	104,138	15,868	99,643	77,517	17,200	33,703	26,621	1,668	306,346
Total	1,412,885	1,112,668	210,984	1,043,538	814,219	194,201	369,347	297,608	16,783	.....
1960										
Jan.	122,565	94,052	22,016	93,197	70,815	20,891	29,368	23,237	1,125	314,237
Feb.	129,259	97,927	26,532	96,888	72,963	25,328	32,371	24,964	1,204	279,684
Mar.	143,708	109,688	27,801	104,742	78,755	26,365	38,966	30,933	1,436	277,982
Apr.	127,219	96,557	26,101	93,433	70,251	24,526	33,786	26,306	1,575	248,902
May	126,580	97,231	26,793	93,700	71,808	25,324	32,880	25,423	1,469	252,293
June	136,992	107,076	29,185	101,294	78,601	27,503	35,698	28,475	1,682	233,765
July	89,565	67,294	16,196	63,753	47,570	15,570	25,812	19,724	626	223,880
Aug.	101,709	77,146	16,113	73,338	55,099	15,207	28,371	22,047	906	213,611
Sept.	104,298	79,556	16,843	74,447	56,126	15,945	29,851	23,430	898	199,413
Oct.	102,664	79,622	14,586	72,544	57,879	13,544	30,120	21,743	1,042	186,311
Nov.	99,577	78,305	15,768	69,927	56,466	14,113	29,650	21,839	1,655	174,317
11 mo.	1,386,800	1,064,076	237,934	937,263	716,533	224,316	346,873	268,121	13,618	.....

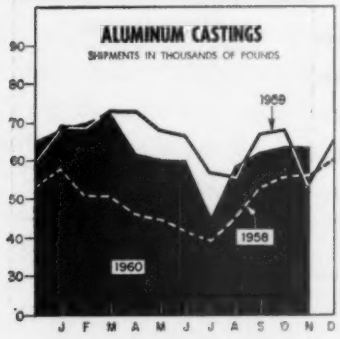
[1]Source: Bureau of the Census. [2]For sale only.

Co., Milwaukee, after 40 years with the company . . . E. C. Chapman has been appointed assistant manager, Sales Development Department, Caterpillar Tractor Co., Peoria, Ill. . . . Wilson P. Burns has joined Erie Malleable Iron Co., Erie, Pa., as assistant to the president, Roger W. Griswold. Mr. Burns formerly was manager, Cleveland works, National Malleable & Steel Castings Co. . . . Cecil E. Maddick has been appointed general manager at Acinfer, a malleable and gray iron foundry in Villa Constitucion, Santa Fe Province, Argentina.

FOUNDRY FIRES: Fire swept through the offices of Lufkin Foundry & Machine Co., Lufkin, Tex., on Feb. 5 and caused damage estimated from $500,000 to $1 million. The loss was particularly high because of recent installation of computing equipment in the area which burned. Fire department officials said that the blaze apparently started in a room housing combination air conditioning and heating units.

Oak Hill Foundry & Machine Co., Oak Hill, Ohio, plans to resume full operations in April after rebuilding from a $100,000 fire which damaged the cleaning room, coreroom, sand mixing department, pattern storage, and machine shop. Limited operations will be carried on until then.

MISCELLANY: Danko Arlington Inc., 4800 E. Wabash Ave., Baltimore 15, Md., has been formed through the merger of Danko Pattern & Mfg. Co. and Arlington Bronze & Aluminum Corp. Products include patterns, permanent molds, and nonferrous castings . . . Allis-Chalmers Mfg. Co., Milwaukee, plans to convert its No. 2 gray iron foundry into a new tractor assembly line. Foundry equipment now in the building will be sold . . . Select Enterprises Inc., Wilmington, Ohio, has been formed to market a scrap breaker which breaks cast iron and rail without pulverizing . . . Philadelphia Industrial Development Corp. will build a $2-1/4 million research building for the Franklin Institute on a site adjacent to the institute's main building . . . Detroit Electric Furnace Div., Kuhlman Electric Co., moved from Bay City, Mich., to Detroit on March 1. It will be housed in a part of the new plant recently acquired by the parent company at 11405 E. State Fair Ave., Detroit 34, Mich.



PRODUCTION WORKERS

Estimated Number

	Nov. 1960	Oct. 1960	Nov. 1959
Ferrous	181,100	182,800	183,200
Nonferrous	47,700	49,300	54,300

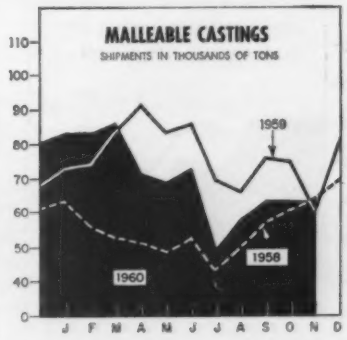
Average Weekly Earnings

Gray Iron	92.13	93.99	93.45
Malleable Iron	91.88	93.99	94.64
Steel	100.99	100.08	95.50
Nonferrous	101.09	102.11	100.61

Average Weekly Hours

Gray Iron	37.3	37.9	39.1
Malleable Iron	36.9	37.9	39.6
Steel	38.4	38.2	37.6
Nonferrous	39.8	40.2	40.9

Source: Bureau of Labor Statistics.



ALUMINUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments Total	Sand	Perm. Mold	Die	Unfilled Orders[2]
1958	641,700	125,487	224,092	290,275	.....
1959					
Nov.	54,695	10,757	16,604	27,219	84,392
11 mo.	721,191	129,619	254,499	335,722	.....
Dec.	65,208	12,368	20,356	32,379	86,947
Total	786,399	141,987	274,855	368,101	.....
1960					
Jan.	68,247	11,278	22,368	34,514	92,109
Feb.	71,699	11,800	23,614	36,177	83,914
Mar.	72,216	12,934	22,413	36,749	78,024
Apr.	61,797	12,339	19,950	29,400	75,243
May	60,330	10,682	21,507	28,055	75,977
June	60,068	11,280	20,953	27,722	74,699
July	45,694	8,765	15,804	20,973	76,434
Aug.	58,848	10,639	18,901	29,256	75,230
Sept.	62,116	10,514	22,031	29,527	75,144
Oct.	63,750	10,149	23,339	30,213	71,364
Nov.	63,406	9,889	23,612	29,831	73,034
11 mo.	688,171	120,279	234,492	29,896	.....

[1]Source: Bureau of the Census. [2]For sale only.

MALLEABLE IRON CASTINGS

(Shipments of castings—net tons[1])

	Shipments Total	For Sale	Standard Total	For Sale	Pearlitic Total	For Sale	Unfilled Orders[2]
1958	660,650	383,839	540,600	313,597	120,050	70,242	.....
1959							
Nov.	58,258	42,235	48,951	33,981	9,307	8,254	82,555
11 mo.	836,302	511,386	668,413	414,055	167,889	97,331	.....
Dec.	80,060	45,917	61,455	35,891	18,605	10,026	93,874
Total	916,362	557,303	729,868	449,946	186,494	107,357	.....
1960							
Jan.	83,188	46,154	63,637	35,933	19,551	10,221	100,302
Feb.	83,118	46,850	64,131	37,391	18,987	9,459	98,272
Mar.	86,243	49,907	67,448	40,422	18,795	9,485	84,679
Apr.	71,271	39,059	56,136	32,066	15,135	6,993	79,237
May	68,942	37,618	53,108	30,128	15,834	7,492	73,240
June	72,593	43,105	55,956	34,526	16,637	8,579	63,920
July	49,860	28,575	37,187	22,477	12,673	6,098	74,329
Aug.	58,785	36,765	46,522	29,077	12,263	7,688	69,853
Sept.	63,048	36,114	48,635	28,623	14,413	7,491	69,033
Oct.	63,521	35,492	47,932	27,813	15,589	7,679	56,516
Nov.	62,978	35,432	47,571	27,611	15,407	7,821	55,627
11 mo.	763,547	435,071	578,263	346,065	175,484	89,006	.....

Prices of Foundry Metals and Coke

(As of February 20, 1961)

FOUNDRY COKE

(Per net ton, f.o.b. ovens)

BEEHIVE

Connellsville	$18.00-$18.50

OVENS

Birmingham	$30.35
Buffalo	32.00
Detroit	32.00
Erie, Pa.	32.00
Indianapolis	31.25
Kearney, N. J.	31.25
Milwaukee	32.00
Neville Island (Pittsburgh)	30.75
New England, deld	33.55
New Haven, Conn.	31.00
Painesville, O.	32.00
Philadelphia	31.00
St. Louis	33.00
St. Paul	31.25
Swedeland, Pa.	31.00
Terre Haute, Ind.	31.25

PIG IRON

(Per gross ton, f.o.b. furnace)

	No. 2 Foundry	Malleable
Birdsboro, Pa.	$68.50	$69.00
Birmingham	62.50	66.50
Boston, deld	77.79	78.29
Buffalo	66.50	67.00
Chester, Pa.	Nom.	Nom.
Chicago	66.50	66.50
Cleveland	66.50	66.50
Duluth	66.50	66.50
Erie, Pa.	66.50	66.50
Fontana, Calif.	75.50	....
Geneva, Utah	66.50	....
Granite City, Ill.	68.40	68.90
Neville Island (Pittsburgh)	66.50	66.50
Swedeland, Pa.	68.50	69.00
Toledo, O.	66.50	66.50
Troy, N. Y.	68.50	69.00
Youngstown, O.	....	66.50

NONFERROUS INGOT

(Cents per pound, carlots)

BRASS AND BRONZE: Red brass, No. 115, 27.25; tin bronze, No. 225, 37.00; No. 245, 31.50; high-leaded tin bronze, No. 305, 31.75; No. 1 yellow, No. 405, 22.75; manganese bronze, No. 421, 26.50.

ALUMINUM: Primary alloy No. 13, 25.90; No. 43, 26.20; No. 195, 27.60; No. 214, 31.50; No. 356, 26.80. Secondary No. 12 alloy, 22.75. Deoxidizing grades: No. 1, 23.75; No. 4, 21.00.

MAGNESIUM ALLOY: AZ91A, 40.75; AZ63A, AZ92A, AZ91C, 40.75, f.o.b. Velasco, Tex.

COPPER: Electrolytic 29.00, delivered Connecticut valley.

ZINC: High grade, 12.85, delivered. Die casting alloy No. 3, 14.25; No. 2, 14.75, delivered.

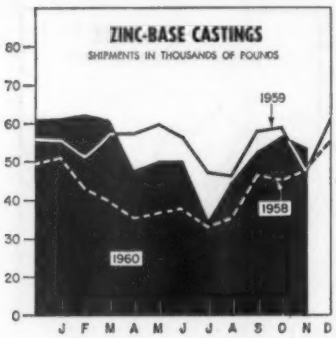
Iron and Steel Scrap

(Consumer prices per gross ton delivered, except as otherwise noted)

	No. 1 Heavy Melting Steel	No. 1 Cupola Cast	Heavy Breakable Cast	Machinery Cast	Structurals, Plates	Malleable	Short Steel Rails
Birmingham	$32.00-33.00	*45.00-46.00	.....	.....	$36.00-37.00	.....	$45.00-46.00
Boston*	**23.00-24.00	**39.00-40.00	.....	**40.00-42.00	.....	.....	.....
Buffalo	27.00-28.00	**36.00-37.00	.....	**43.00-44.00	37.00-38.00	.....	46.00-47.00
Chicago	31.00-32.00	41.00-42.00	.....	46.00-47.00	37.00-38.00	43.00-44.00	47.00-49.00
Cincinnati*	**26.50-27.50	**35.00-36.00	**28.00-29.00	**46.00-47.00	.....	.....	**44.00-45.00
Cleveland	29.00-30.00	37.00-38.00	26.00-27.00	44.00-45.00	36.00-37.00	42.00-43.00	49.00-50.00
Detroit*	**20.00-21.00	**29.00-30.00	**22.00-23.00	.....	.....	.....	.....
Los Angeles	30.00	39.00	.....	.....	40.00	.....	.....
New York*	27.00-28.00	34.00-35.00	28.00-29.00	.....	31.00-32.00	.....	.....
Philadelphia	39.00	38.00	39.00	48.00-49.00	41.00-43.00	46.00	50.00-52.00
Pittsburgh	31.00-32.00	**32.00-33.00	.....	**44.00-45.00	33.00-35.00	.....	50.00-52.00
St. Louis	27.00	38.00	31.00	.....	.....	.....	40.00
San Francisco	32.00	46.00-48.00	28.00	45.00-46.00	40.00	.....	.....
Seattle	36.00-39.00	39.00	36.00-37.00	.....	.....	.....	.....

*Brokers' buying prices. **F.o.b. shipping point

Foundry Statistics



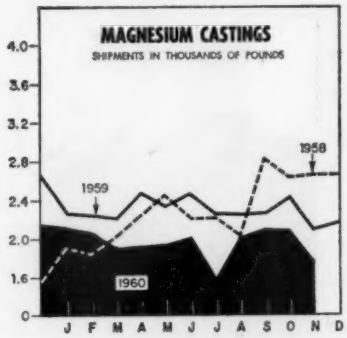
PIG IRON

PRODUCTION—Net Tons**

	Foundry	Malleable & Silvery	Low & Int. Low Phos. & Bessemer
1958	1,622,320	2,448,917	4,954,854
1959			
Dec.	177,017	306,303	452,426
Totals[3]	1,589,445	2,810,359	3,471,683
1960			
Jan.	128,232	325,151	462,667
Feb.	148,238	338,866	471,755
Mar.	126,357	333,182	462,914
Apr.	134,509	258,452	395,875
May	135,825	290,057	356,931
June	105,717	247,991	309,942
July	117,218	166,084	290,384
Aug.	78,950	171,718	211,506
Sept.	93,260	202,895	152,880
Oct.	133,525	183,639	208,758
Nov.	122,550	231,203	206,062
Dec.	130,455	153,009	202,353
Totals	1,454,836	2,904,918	3,738,606

CONSUMPTION*—Gross Tons

	Cupola	Air	Electric
1958	3,314,652	169,267	231,145
1959			
Oct.	351,679	20,011	5,749
10 mo.	3,378,437	188,905	276,079
Nov.	276,168	16,350	28,231
Dec.	334,524	18,613	47,045
Total	3,989,129	223,868	351,355
1960			
Jan.	328,242	18,634	45,936
Feb.	322,945	19,257	42,883
Mar.	317,520	21,042	43,959
Apr.	282,178	16,796	34,971
May	292,407	15,730	19,869
June	313,340	16,828	23,720
July	241,752	11,892	21,123
Aug.	273,722	14,697	27,919
Sept.	284,809	13,548	19,962
Oct.	269,103	13,631	13,947
10 mo.	2,925,018	162,055	296,289



ZINC-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1958	500,071	319,471	.....
1959			
Nov.	44,611	35,301	58,076
11 mo.	572,714	405,603	.....
Dec.	58,496	37,406	65,723
Total	631,210	443,009	.....
1960			
Jan.	61,537	39,777	64,940
Feb.	62,925	42,089	66,945
Mar.	60,816	39,618	60,267
Apr.	47,553	31,423	56,312
May	50,844	33,551	56,654
June	50,809	34,264	51,960
July	35,117	25,186	52,392
Aug.	45,101	32,549	57,551
Sept.	52,514	34,451	57,480
Oct.	56,205	36,459	57,028
Nov.	53,574	33,758	55,306
11 mo.	576,994	383,125	.....

MAGNESIUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1958	28,776	25,024	.....
1959			
Nov.	2,012	1,618	3,281
11 mo.	25,098	21,388	.....
Dec.	2,154	1,721	3,423
Total	27,253	23,109	.....
1960			
Jan.	2,135	1,588	3,209
Feb.	2,075	1,679	3,278
Mar.	1,903	1,524	3,206
Apr.	1,926	1,533	3,138
May	1,953	1,514	2,948
June	2,050	1,555	3,396
July	1,638	1,234	3,541
Aug.	2,025	1,530	3,364
Sept.	2,146	1,653	3,271
Oct.	2,038	1,519	3,274
Nov.	1,776	1,269	3,722
11 mo.	21,665	16,598	.....

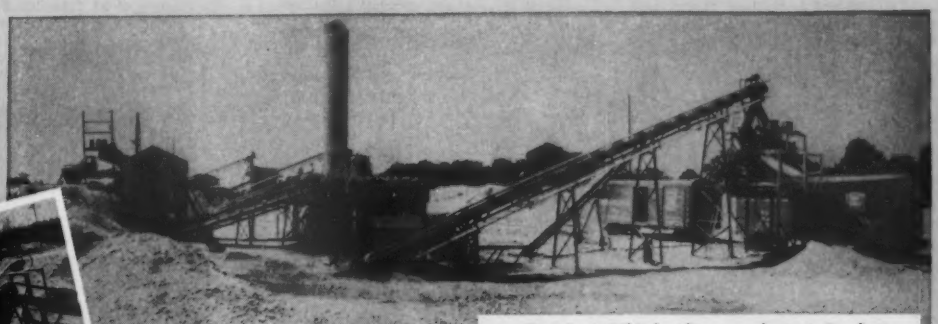
*Source: U. S. Dept. of Interior Bureau of Mines. **Source: American Iron & Steel Institute. [1]Source: Bureau of the Census. [2]For Sale only. [3]Monthly figures do not add up to totals shown because of unreported monthly revisions.

NOW YOU CAN BUY DORCHESTER MC* SAND MULLED

CAN'T FREEZE

SAVES MONEY

READY TO USE



Muller of new design manufactured by National Engineering Company

Another first! Whitehead's new plant at Dorchester. View shows how sands are processed and loaded on freight cars by equipment of latest design.

WHITEHEAD'S

* MOISTURE CONTROLLED

AND MULLED

NATURAL BONDED

DORCHESTER MOLDING SANDS

AND GRAVELS

Guaranteed Moisture Content Not Above 6%

With Whitehead's new plant in full operation, Dorchester Molding Sands arrive at your foundry completely mulled, if so ordered. Each grain of sand is evenly coated with its natural bond of clay.

Widely used for Cores and Molds in Iron, Steel, Alloys, and Non-Ferrous Castings, the famous Dorchester Molding Sands are noted for Colloidal clay giving high green and dry strength. Because of the low fines in grain distribution, these sands have a high permeability.

1 ***Moisture Controlled Sands Do Not Freeze—***

a. Easier to unload . . . means lower unloading costs.

b. Reduces handling costs to and from storage bins.

2 ***Moisture Controlled Sands Are Economical—***

a. Sand with 15% moisture have 1700 lbs. sand and 300 lbs. water in each ton.

b. Moisture Controlled Sands with 6% moisture have 1880 lbs. sand and 120 lbs. water in each ton.

c. On each ton of Moisture Controlled Sands you SAVE price of sand and freight on 180 lbs. of water. Sand has just right amount of moisture to eliminate dust hazard.

3 ***Ready to Use on Arrival at Foundry—***

a. Dorchester Moisture Controlled Sands and Gravels arrive with proper working moisture content so that they can be used at once.

b. Aids you in control for sand at foundry.

Whitehead Brothers COMPANY

Established 1841

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324 West 23rd St., New York 11, N. Y.

NEW ENGLAND OFFICE
75 Westminster St., Providence 1, R. I.

Manufacturers of:

LYQUAGRIP
Ready-to-use core paste

DOB-IT
Ready-to-use core mudding compound

JOINT-SEAL
Plastic compound for perfect sealing

LYQUAFLOUR
For cleaner surface, better shakeout

LYQUAFACE
The liquid sand grain coating

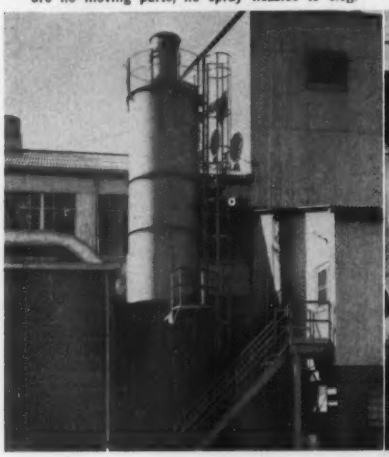
Circle 566 on Page 39

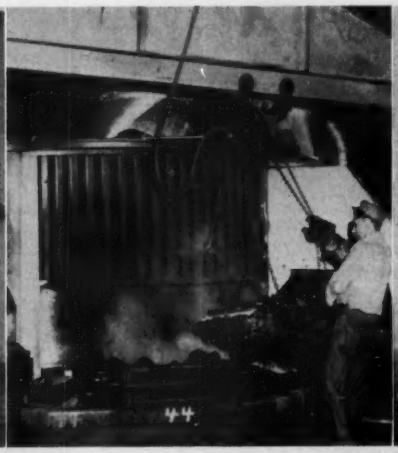
MULTI-WASH COLLECTORS OFFER THESE ADVANTAGES:

■ **HIGH EFFICIENCY** (up to 99.9%) for the removal of dust and fumes from hooded work stations is provided by **Schneible Multi-wash Collectors.** Waste flows continuously to a central dewatering tank where settling process clarifies water for return to scrubber for reuse. There are no moving parts, no spray nozzles to clog.

■ **CLEAN DUST-FREE OPERATION** of mold parting stations with complete control of air is provided with standard **UNI-FLO HOOD.** Adjustable louvers allow for efficient air distribution and compensation for unusual air currents. Workmen are not subject to drafts or dust and fume spillover.

■ **FLEXIBILITY AND ADAPTABILITY** is a feature of all **Schneible UNI-FLO SHAKEOUT HOODS.** They may be used at hand operated, low-volume stations or high production lines where molds are handled by crane, monorail or pusher. One, two or three sides may be open as required.



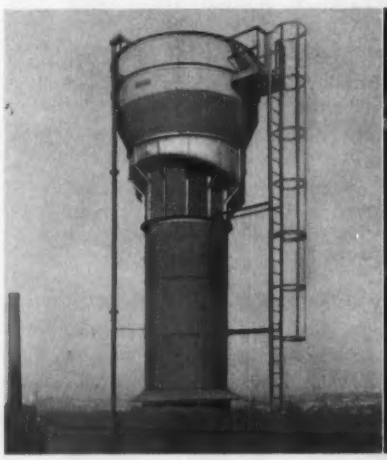


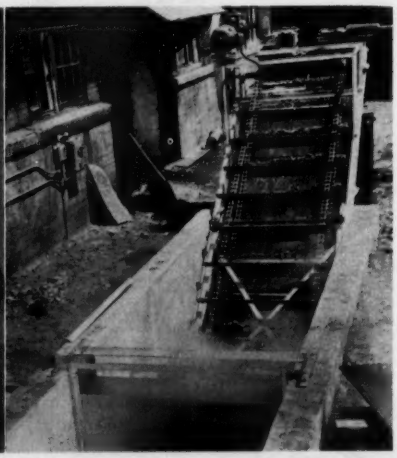
'SW' CUPOLA COLLECTOR SYSTEM HAS PROVEN BENEFITS YOU NEED!

■ **ELIMINATE COSTLY CLEANING AND REPAIRING** of roof and sash due to acid action of fly ash and fumes. **'SW' CUPOLA COLLECTOR** with patented non-clogging distribution head supplies heavy water curtain to stop fly ash and fume emissions. No fans, motors, spray nozzles or moving parts to maintain.

■ **SAVE MANPOWER** with automatic slag quench equipment. Slag is sluiced to a central disposal tank for easy removal. There is no secondary pollution problem in handling. Waste is removed as sludge to dumping facility after settling process is completed. Clarified water is pumped back for reuse.

■ **AUTOMATIC WASTE DISPOSAL** of fly ash and slag from central dewatering tank. Choice of method of removal is available. Standard tank designs permit use of tote boxes or clamshell to truck, depending on size of operation. Constant water flow assures continuous movement of waste from all areas.





AIR POLLUTION
SCHNEIBLE
CONTROL

Refer to Sweet's Plant Engineering File No. 1e 5c

PRODUCTS:

Multi-Wash Collectors • Uni-Flo Standard Hoods • Uni-Flo Compensating Hoods • Uni-Flo Fractionating Hoods • Water Curtain Cupola Collectors • Ductwork • Velocitrap • Multi-Dyne Separators • Entrainment Separators • Settling and Dewatering Tanks • Skimmer Type Concentrating Tanks • Pressure Vessels and Storage Tanks

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CLAUDE B. SCHNEIBLE COMPANY

P.O. Box 296, Roosevelt Park Annex

Detroit 32, Michigan TA 5-7772

Malleable Founders Society Plans Technical Conference

Malleable Founders Society will present a top-flight panel of speakers at its 1961 Technical and Operating Conference, to be held at the Pick-Carter Hotel, Cleveland, March 1-2.

Dorian Shainin, vice president, Rath & Strong, Boston, will discuss cost reduction in the foundry through use of statistical analysis.

New materials, machines, and processes — including furan type binders, plastic patterns, and flaskless molding—will be discussed at one session. At the same session, J. Homer Winkler, Battelle Memorial Institute, will talk about research in other industries.

J. H. Winkler

E. W. Hess

E. W. Hess, Minnesota Mining & Mfg. Co., will describe use of structural adhesives. This session also will hear discussion of welding and brazing developments and effective gating and risering, the latter by John F. Wallace, Case Institute of Technology.

A panel discussion will be devoted to "Supervisor's Position on the Management Team."

W. S. Pellini Honored by Navy

William S. Pellini, superintendent, Metallurgy Div., U. S. Naval Research Laboratory, Washington, recently was presented the Navy's highest civilan award. He received the Navy Distinguished Civilian Service Award in "recognition of his contributions to the design and construction of ships and submarines of the U. S. Navy."

AFS Congress Program Developing

● TECHNICAL PROGRAM for the American Foundrymen's Society Castings Congress in San Francisco, May 8-12, is well advanced.

Approximately 55 individual technical sessions, shop courses, and roundtable luncheons are scheduled for presentation of some 100 papers.

Subjects to be discussed during each of the five days of the Congress follow:

Monday—Brass and Bronze, Malleable Iron, Patterns, Heat Transfer, Sand, Safety and Hygiene.

Tuesday—Brass and Bronze, Malleable Iron, Light Metals, Patterns, Industrial Engineering and Costs, Gray Iron, Sand, Education.

Wednesday—Gray Iron, Ductile Iron, Malleable Iron, Light Metals, Industrial Engineering and Costs, Plants and Equipment, Steel, Diecasting and Permanent Mold Casting, Sand.

Thursday—Ductile Iron, Diecasting and Permanent Mold Casting, Fundamental Papers, Steel, Vacuum Melting and Casting, Sand, Gray Iron.

Friday—Ductile Iron, Fundamental Papers, Sand.

The AFS annual business meeting and Hoyt Memorial Lecture will be held Wednesday morning. John B. Caine, foundry consultant, will present the Hoyt Lecture on "Cast Metals and Cast Shapes."

Officers and Directors—The following nominees have been selected for election at the annual business meeting: President, Albert L. Hunt, executive vice president, Superior Foundry Inc., Cleveland; vice president, John A. Wagner, president, Wagner Castings Co., Decatur, Ill.

Director nominees are Daniel B. Best, superintendent, Brass & Iron Foundries, Bethlehem Steel Co., Bethlehem, Pa.; Roger J. Hageboeck, vice president, Frank Foundries Corp., Moline, Ill; Dale Hall, works manager, Oklahoma Steel Castings Co., Tulsa, Okla.; C. J. Lonnee, president, Alloyed Grairon Casting Corp., Ravenna, Mich.; Charles Ossenfort, foundry superintendent, Fairbanks, Morse & Co., Kansas City, Kans.; Carl O. Schopp, assistant general superintendent, Link-Belt Co., Indianapolis.

Awards—Presentation of Awards of Scientific Merit and Service Citations also will be made at the business meeting. Gold Medal awards will be made at the annual banquet Wednesday evening. Recipients selected by the AFS Board of Awards follow:

Gold Medals: Merton C. Flemings Jr., assistant professor of metallurgy, Massachusetts Institute of Technology—the Peter L. Simpson Gold Medal.

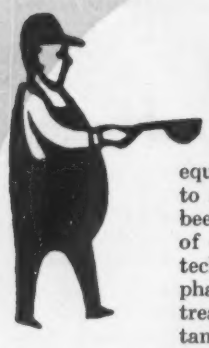
Old-time cable cars still are popular means of transportation up and down San Francisco's steep hills

William S. Pellini, head, Metallurgy Dept., Naval Research Laboratory, Washington—the John A. Penton Gold Medal.

Scientific Merit: Harvey E. Henderson, technical director, research department, Lynchburg Foundry Co., Lynchburg, Va.; Theodore R. Schroeder, foundry superintendent, Pontiac Motor Div., Pontiac, Mich.; Herbert J. Weber, director, AFS Safety, Hygiene & Air Pollution Control Program.

Service Citations: Alexander D. Barczak, operation vice president, Superior Foundry Inc., Cleveland; Kenneth M. Smith, staff engineer, Caterpillar Tractor Co., Peoria, Ill.;

Wherever aluminum needs heat



LINDBERG FISHER

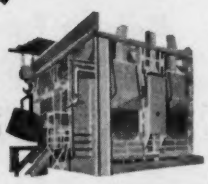
You'll find this nameplate on all the equipment you'll need for applying heat to aluminum. Heat and aluminum have been Lindberg's babies for years. Our staff of expert engineers, metallurgists and technicians is widely experienced in all phases of aluminum melting, casting, and treating and has pioneered many important developments in aluminum processing by heat. Today, Lindberg offers you a complete line of heating equipment for every requirement in this field. This includes every needed type of melting, holding or heat treating furnace, large and small, shop built or field erected, fuel fired or electric (resistance, 60 cycle induction, arc or high frequency). We hope you'll let our symbolic friend, "Little Joe", guide you through the exposition of this equipment offered on these pages.

Meet "Little Joe"! He looks something like a fellow in our plant but we really use him as a symbol of the good right hand of service Lindberg-Fisher's expert design staff and our complete line of "heat for aluminum" equipment is able to render you.

Hot Metal Delivery

MELTING

"RIGHT FROM THE START, LINDBERG EQUIPMENT TAKES OVER YOUR ALUMINUM HEATING NEEDS."

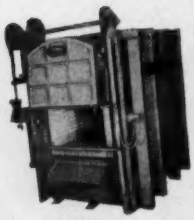


Fuel fired reverberatory. Charging well optional.

"MOLTEN METAL FROM REDUCTION CELLS IS HELD, OR INGOTS MELTED, IN FURNACES LIKE THESE."

CASTING STATION

"MOLTEN METAL IS HELD AT THE CORRECT TEMPERATURE UNTIL PROCESSED INTO CASTINGS."

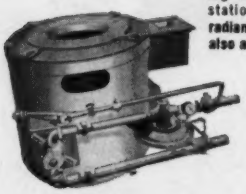


Fuel fired reverberatory, holding or melting.

"MANY CASTING STATION FURNACES CAN BE EQUIPPED WITH THE LINDBERG AUTOLADLE, NAMED 'LITTLE JOE', AFTER ME."

Autoladle for automatic ladling, four shot sizes available, up to 100 lbs.

HYNI nitrogen generator, for atmosphere melting and fluxing.



Fuel fired crucible or pot, holding or melting, stationary. **New radiant wall type also available.**

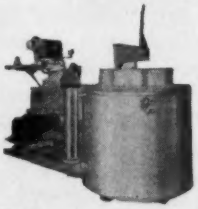
SPECIAL EQUIPMENT

"SOME CASTINGS MAY REQUIRE HEAT TREATMENT AND THESE ARE HANDLED IN THE FURNACES BELOW."

Gas fired billet heater for extrusions.

HEAT

Cyclone heat treating, electric or fuel fired, box or pit.



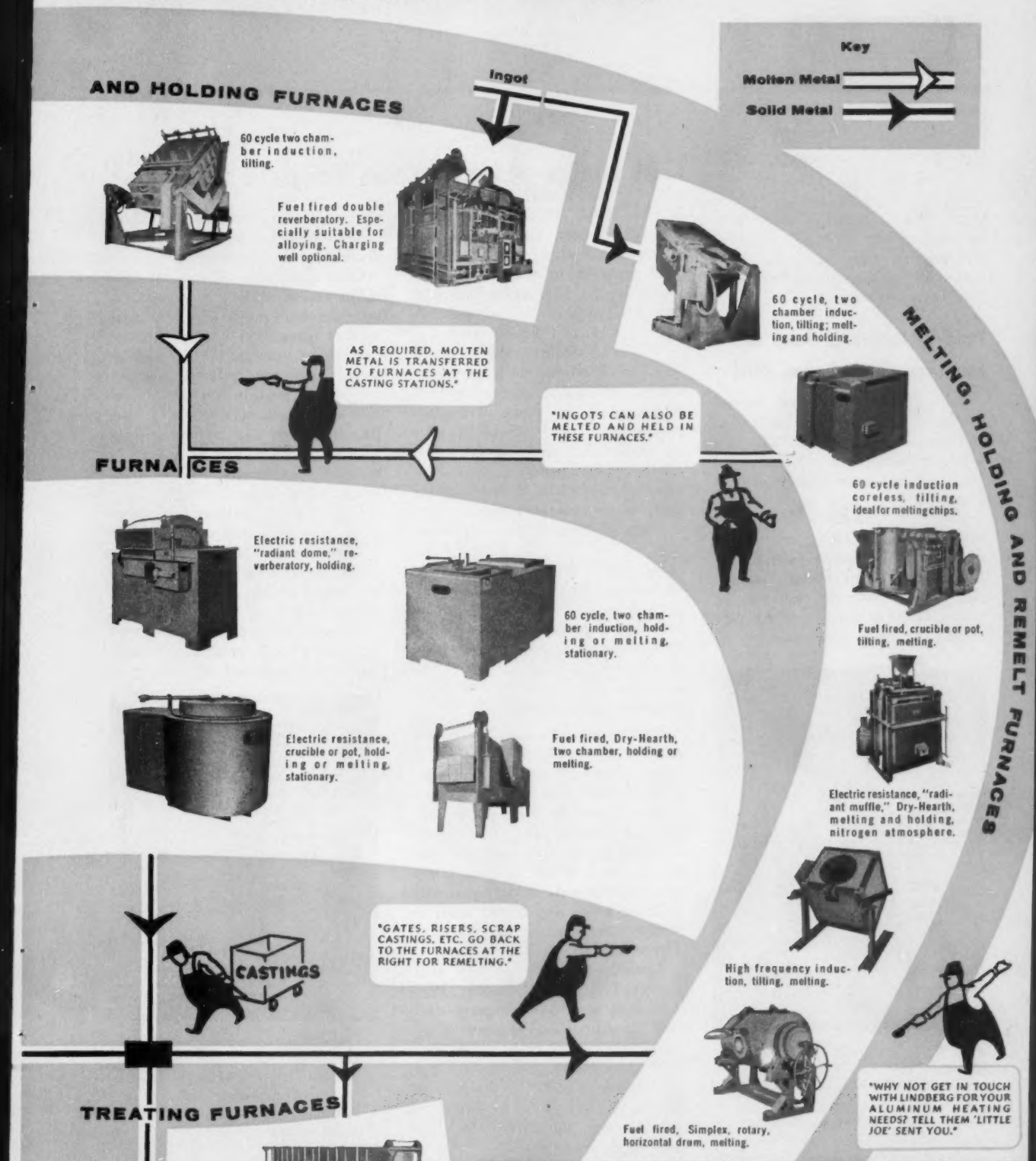
Cyclone heat treating, electric or fuel fired, box or pit.

60 cycle induction billet heater for extrusions.

"SO, DOWN TO THE FINISHED PRODUCT, LINDBERG EQUIPMENT TAKES CARE OF EVERY STEP."

BILLETS RODS CASTINGS

LINDBERG equipment will apply it


Key
Molten Metal
Solid Metal
Ingot
AND HOLDING FURNACES
60 cycle two chamber induction, tilting.
Fuel fired double reverberatory. Especially suitable for alloying. Charging well optional.
60 cycle, two chamber induction, tilting; melting and holding.
MELTING, HOLDING AND REMELT FURNACES
AS REQUIRED, MOLTEN METAL IS TRANSFERRED TO FURNACES AT THE CASTING STATIONS."
"INGOTS CAN ALSO BE MELTED AND HELD IN THESE FURNACES."
FURNACES
60 cycle induction coreless, tilting, ideal for melting chips.
Fuel fired, crucible or pot, tilting, melting.
Electric resistance, "radiant dome," reverberatory, holding.
60 cycle, two chamber induction, holding or melting, stationary.
Electric resistance, crucible or pot, holding or melting, stationary.
Fuel fired, Dry-Hearth, two chamber, holding or melting.
Electric resistance, "radiant muffle," Dry-Hearth, melting and holding, nitrogen atmosphere.
CASTINGS
"GATES, RISERS, SCRAP CASTINGS, ETC. GO BACK TO THE FURNACES AT THE RIGHT FOR REMELTING."
High frequency induction, tilting, melting.
Fuel fired, Simplex, rotary, horizontal drum, melting.
"WHY NOT GET IN TOUCH WITH LINDBERG FOR YOUR ALUMINUM HEATING NEEDS? TELL THEM 'LITTLE JOE' SENT YOU."
TREATING FURNACES
Homogenizing cyclone heat treating, electric or fuel fired, box.
D.C. INGOTS

Circle 568 on Page 39

We'll be glad to discuss your aluminum processing needs with you. Get in touch with your local Lindberg Representative (see your classified phone book) or write us direct.

LINDBERG FISHER DIVISION

LINDBERG ENGINEERING COMPANY

2450 West Hubbard Street, Chicago 12, Illinois

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also Lindberg plants in Argentina, Australia, England, France, Italy, Japan, South Africa, Spain, Switzerland, and West Germany.

Jess Toth, vice president, sales, Harry W. Dietert Co., Detroit.

Applications for hotel accommodations at San Francisco were sent by the society to AFS members recently. All reservations are being made through the housing bureau in San Francisco.

Predicts Upturn in Sales of Farm Equipment During 1961

Sales of farm equipment should increase 15 per cent in 1961, it is predicted by Merritt D. Hill, vice president and general manager, Ford Motor Co.'s Tractor and Implement Div.

Excessive inventories of tractors and other farm machinery a year ago resulted in low production during 1960. Tractor output, for instance, was down 45 per cent, he points out, but surplus stocks now appear to have been worked off.

FIRE EYE—Sensitivity of a new fire detecting electronic tube, the size of a golf ball, is shown being demonstrated by Dr. John B. Johnson of Thomas A. Edison Industries as he activates the tube (mounted under protective wickets) with a lighted candle. The tube, known as a "U-V Detector," is sensitive only to ultraviolet radiation in flame. It was developed to be used as a fire detector to provide a nearly instantaneous alarm or in flame-out applications to detect the absence of flame in combustion chambers.

GM Licks Aluminum Engine Bugs

● CENTRAL FOUNDRY DIV., General Motors Corp., has announced that aluminum block and head castings production for the Buick Special, Oldsmobile 85, and Pontiac Tempest V-8 engines has reached a normal quality level.

A few difficulties often experienced when production is started on newly designed engines were encountered at the outset of castings production. These difficulties were no greater, according to James H. Smith, general manager, than those experienced by the division in the past when new gray iron engine castings were being put in production.

Mr. Smith went on to say that current scrap rates for the semipermanent molded aluminum blocks and heads are running below the rates anticipated and budgeted for the current production year. The rates are about one-third of what they were a few months ago.

Development Work—Before castings for the newly-designed engines were released for production, foundry development and testing work was conducted by the Bedford, Ind., plant of Fabricast Div. and Central Foundry Div.'s stress analysis laboratory. By late fall of 1958 prototype engines were being tested with cylinder heads and blocks made in semipermanent molds. See FOUNDRY, December 1960, p. 66, for story.

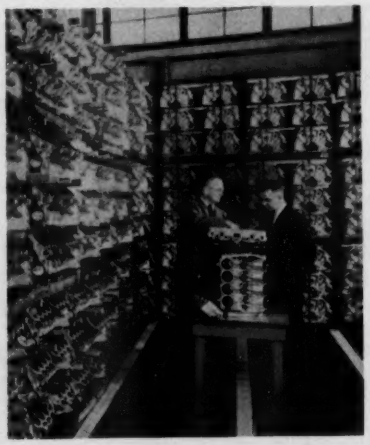
Consolidation of Fabricast with Central Foundry Div. in May, 1959, combined into one company division the experience important to this new development project. Technical and supervisory people from Fabricast were brought to the Central Foundry Div. plant at Defiance, Ohio, where the aluminum blocks and heads are produced.

Among other duties, they inaugurated an off-the-job training program for employees selected for the aluminum casting work. Sessions included explanation of conditions peculiar to the casting of aluminum, causes of scrap, the importance of each step in the permanent molding process, and the showing of movies illustrating the work.

Close Control — Many developments and controls in materials and processes were required before high-volume production could be attained. For example, a urea formaldehyde core sand mixture was developed to provide low gas evolution and good collapsibility. Also, this core sand can be prepared in conventional mullers, blown in standard coreblowers, and baked in conventional ovens.

Gages were designed to check mold alignment and core locations in the hot and cold state during initial setup and operation. Cores are gaged in the molds to insure proper location.

A series of inspections and tests at every step in production culminates in compressed air testing of

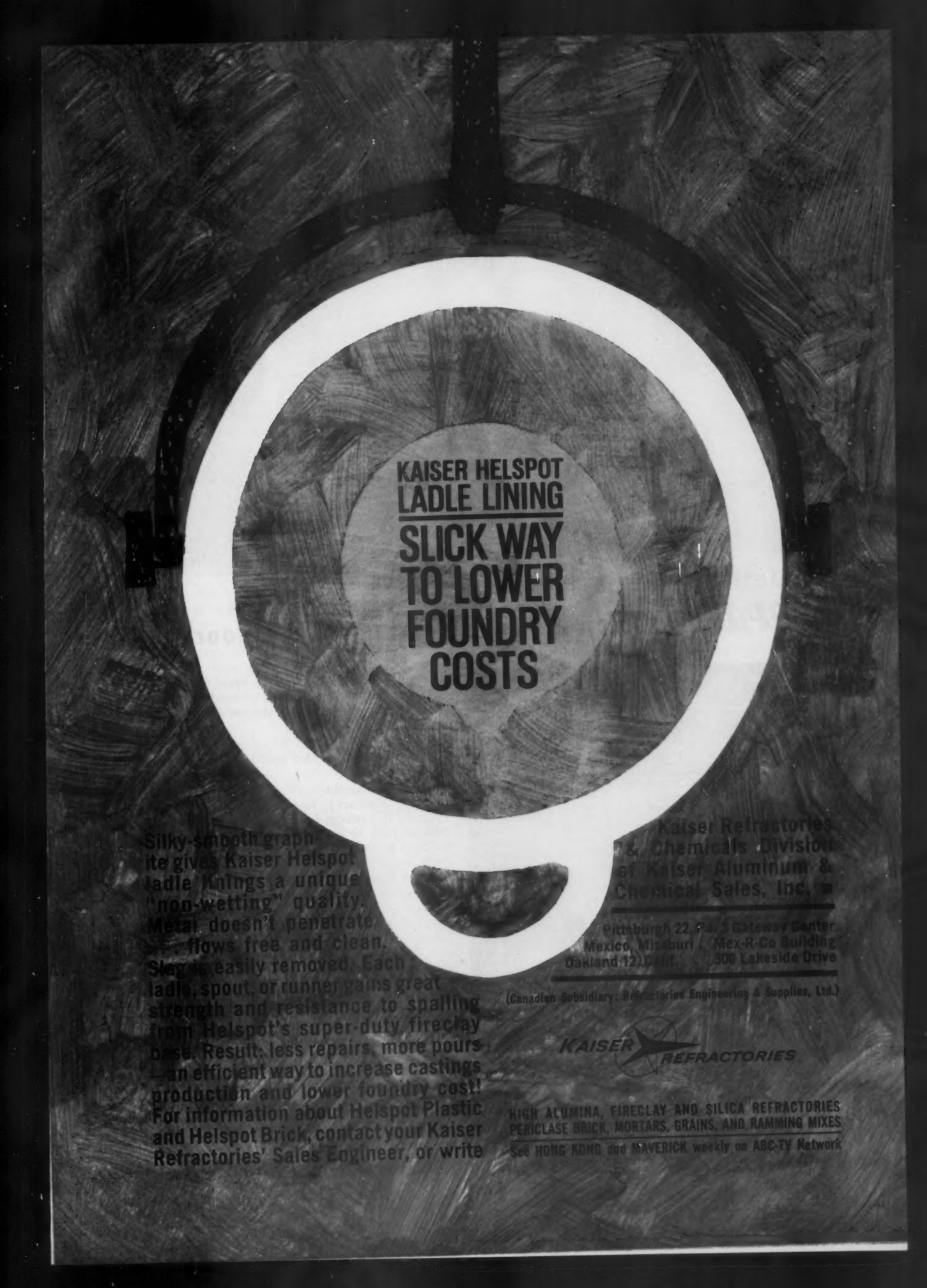


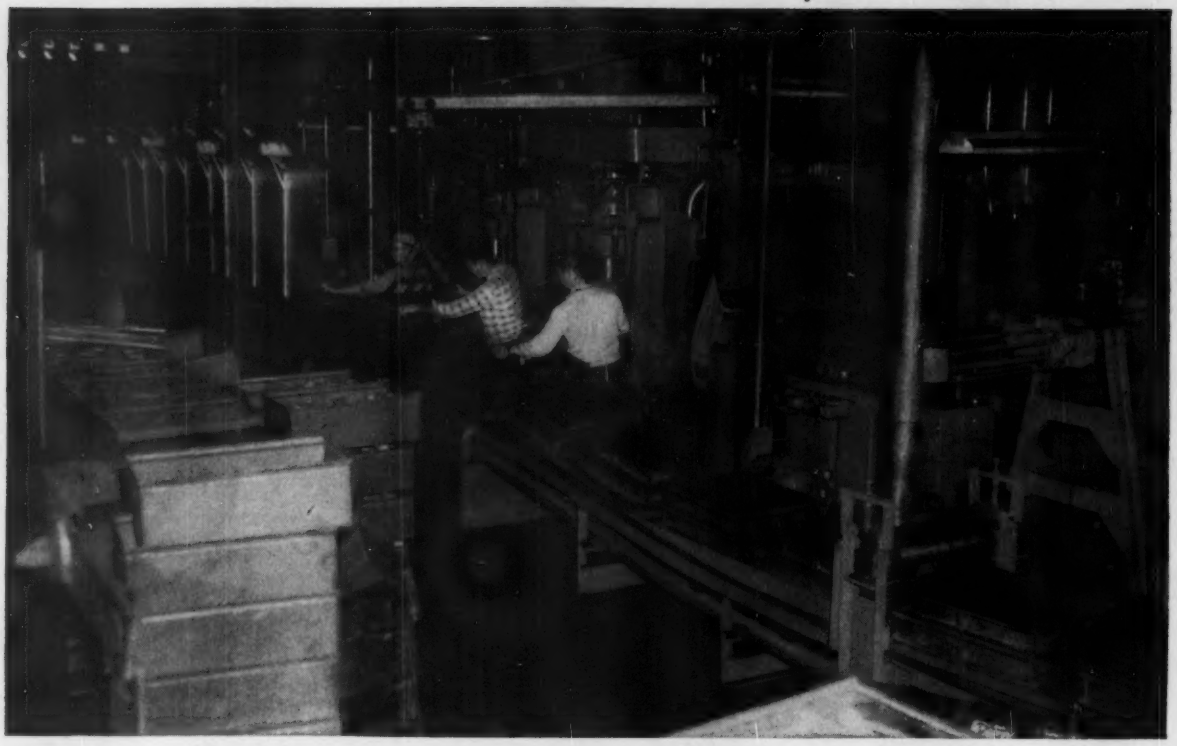
The Defiance aluminum plant can cast over 1300 blocks and 2600 heads in a day. James H. Smith, divisional general manager, at left, and T. R. Wiltse, plant manager, inspect a head

block and head castings submerged in water, and gaging for dimensional reliability. At this point cylinder heads are ready for shipment.

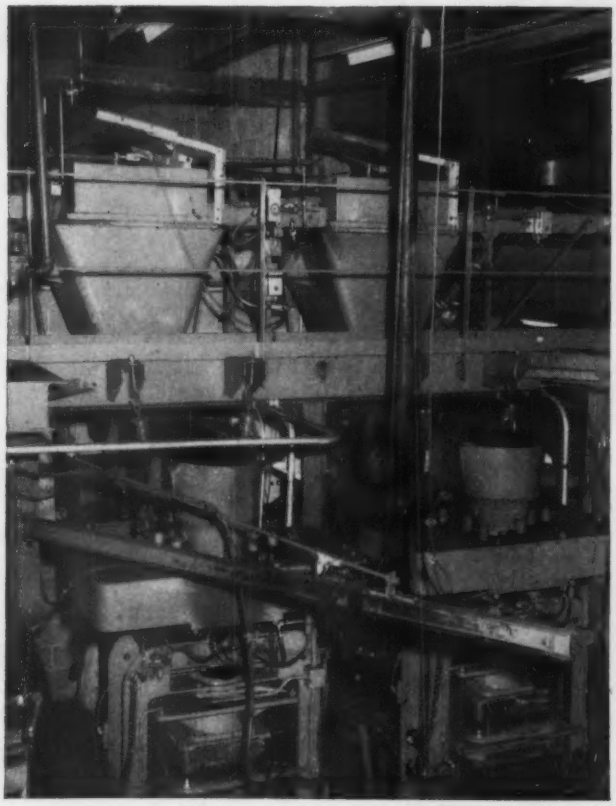
Block castings go through an automatic qualifying machine which locates and mills end and side target

Circle 569 on Page 39→


KAISER HELSPOT
LADLE LINING
SLICK WAY
TO LOWER
FOUNDRY
COSTS
Silky-smooth graph-
ite gives Kaiser Helspot
ladle linings a unique
"non-wetting" quality.
Metal doesn't penetrate
. . . flows free and clean.
Slag is easily removed. Each
ladle, spout, or runner gains great
strength and resistance to spalling
from Helspot's super-duty fireclay
base. Result: less repairs, more pours
—an efficient way to increase castings
production and lower foundry cost!
For information about Helspot Plastic
and Helspot Brick, contact your Kaiser
Refractories' Sales Engineer, or write
Kaiser Refractories
& Chemicals Division
of Kaiser Aluminum &
Chemical Sales, Inc.
Pittsburgh 22, Pa., 3 Gateway Center
Mexico, Missouri, Mex-R-Co Building
Oakland 12, Calif., 300 Lakeside Drive
(Canadian Subsidiary: Refractories Engineering & Supplies, Ltd.)
KAISER REFRACTORIES
HIGH ALUMINA, FIRECLAY AND SILICA REFRACTORIES
PERICLASE BRICK, MORTARS, GRAINS, AND RAMMING MIXES
See HONG KONG and MAVERICK weekly on ABC-TV Network



With Jeffrey's engineering assistance, *TAPPAN* production is doubled in half the floor space



The 400-foot L-shaped Jeffrey Mold Conveyor, used in connection with semi-automatic molding machines, made it possible to reduce the molding area to one-half its previous size.

Capacity of the sand handling system supplied by Jeffrey 15 years ago was increased from 35 to 65 tons per hour.

Murray Manufacturing Company's foundry at Murray, Kentucky, has recently been expanded to produce all castings for all Tappan stove plants. The problem was to double this plant's past production without having to increase its size. With Jeffrey's help, the area devoted to molding was cut in half, making this space available for other operations.

A Jeffrey Mold Conveyor is the heart of the new layout. All molding and pouring takes place on this continuous conveyor, with a mold being completed every 15 seconds. Jeffrey vibrating conveyors handle the shakeout, sand and castings. Under the new system, a standard flask size was adopted, instead of the five sizes used before, contributing to greater production and efficiency.

Jeffrey foundry equipment is described in Catalog 911. For a copy, write The Jeffrey Manufacturing Company, 907 North Fourth St., Columbus 16, Ohio.

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT...
TRANSMISSION MACHINERY... CONTRACT MANUFACTURING

Circle 570 on Page 39

points in relationship to the cylinder bores. A final dimensional check is made on an air-electronic gaging machine which locates on the milled target points and checks 22 dimensionally critical areas.

VANADIUM—This 14-in. OD, 60-lb ring is believed to be the largest vanadium centrifugal casting produced commercially, according to Oregon Metallurgical Corp., Albany, Oreg., the maker. The company uses the vacuum-skull-melting process and pours into spinning graphite molds. Cast rings are said to have finer grain structure than ingots.

Steel Founders To Meet at Chicago on March 13-14

Marking 100 years of casting steel, the Steel Founders' Society of America looks to the future in the program for its annual meeting in Chicago. The meeting is scheduled for the Drake Hotel, Chicago, March 13-14.

Program details follow:

Monday, March 13

8:30 a.m.—Registration.

10 a.m.—President's Report—President W. H. Moriarty, first vice president and group executive, National Malleable & Steel Castings Co., Cleveland.

Treasurer's Report—Treasurer R. G. Parks, treasurer, National Malleable & Steel Castings Co., Cleveland.

"The Association of the Future," F. Kermit Donaldson, executive vice president of SFSA. Dr. Pierre Rinfret, vice president and director of the Economics Dept., Lionel D. Edie & Co., New York (title to be announced).

12 noon—Reception and luncheon. Presentation of awards and medals.

2:30 p.m.—**"Change Is Certain—Progress Is Planned,"** Dale L. Hall, chairman of SFSA Technical and Operating Committee, and works manager, Oklahoma Steel Castings Co., Div. American Steel & Pump Corp., Tulsa, Okla. **"Steel Casting Design for the Future,"** John B. Caine, metallurgist and design engineer, Cincinnati. **"The Next Ten,"** Frank G. Steinebach, publisher and editorial director, FOUNDRY, Cleveland.

Tuesday, March 14

9:30 a.m.—Motion Picture: "Rice Bowls to Rockets."

10 a.m.—**"Remarks by Counsel,"** Chauncey Belknap. **"A Blueprint for Businessmen in Politics—Post 1960,"** Willard V. Merrihue, manager, Community & Business Relations, General Electric Co., New York. **"Profitable Pricing for Foundry Products,"** Bertrand J. Belda, partner and central district director of management services, Ernst & Ernst, Cleveland.

12 noon—Reception and Luncheon.

"American Business in the Months Ahead," Robert Kazmayer, publisher, *Things To Watch For*, New York.

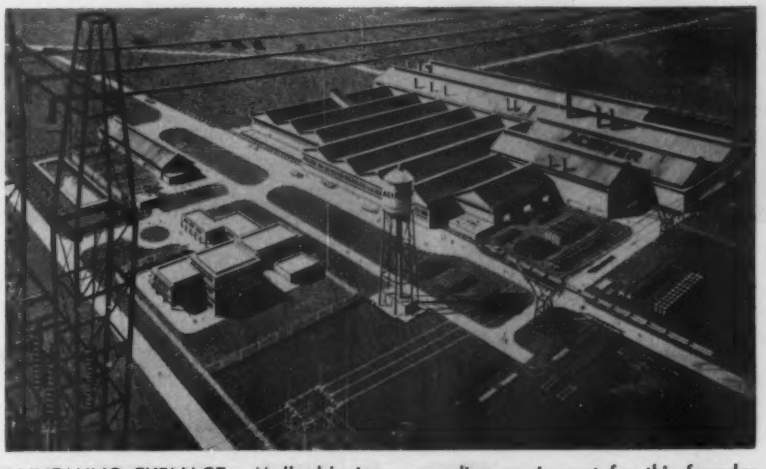
Texans Plan 1962 Conference

Texas Chapter, AFS, is planning a Texas Regional Conference to be held at the Menger Hotel, San Antonio, March 15-16, 1962. C. R. McGrail, Alamo Iron Works, San Antonio, will be conference chairman and Ross Williams, East Texas Steel Castings Co., Longview, Tex., program chairman.

Aluminum Output Sets Record

Five-year report from the Aluminum Association, New York, shows that more primary aluminum was produced in 1960 than in any of the four previous years. Total production for 1960 was 2,014,499 short tons, compared with 1,953,019 for 1959. Total for December, 1960, was 165,504 short tons, just over the 162,996 produced during the same month in 1959.

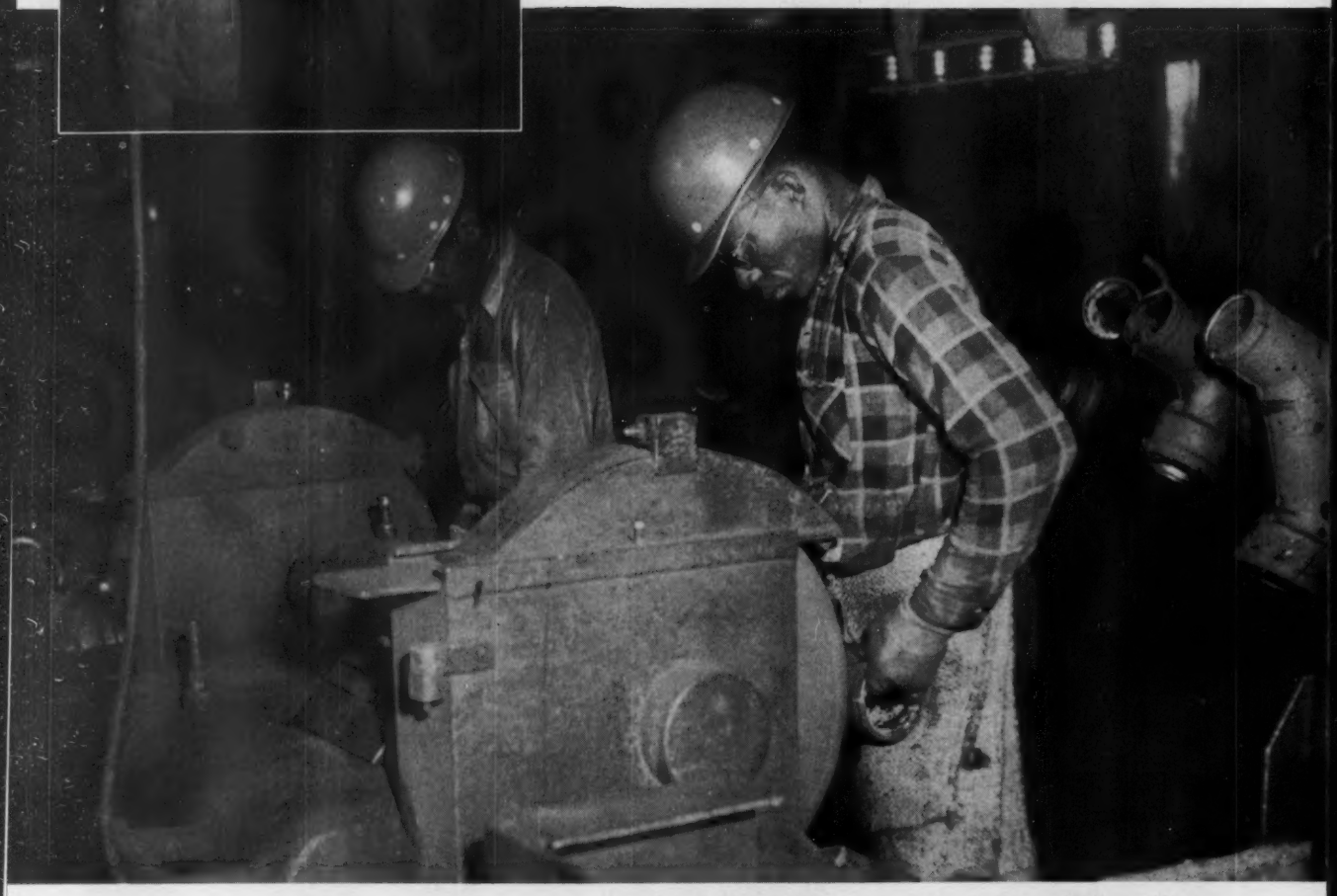
ANNIVERSARY—The 75th anniversary of Charles Martin Hall's discovery of the electrolytic process which made aluminum commercially abundant was observed Feb. 16 at Oberlin College, Oberlin, Ohio. The celebration was sponsored by the Aluminum Association. This aluminum statue of Mr. Hall is in Severance Chemical Laboratory at Oberlin from which he was graduated in 1885.



ANNEALING FURNACE: Malleable iron annealing equipment for this foundry in Argentina recently was ordered from the General Electric Co. The furnace, 18 ft wide by 11 ft high and 81 ft long, will be installed at the new plant of Acinfer, S. A., of Villa Constituciun, Argentina. It will be gas fired, operating on a 37-hour cycle, with monthly capacity of 500 tons. Lester B. Knight International Corp., Chicago, is co-ordinating the project

How Frank Jones

John Warner (left), Foundry Superintendent, checks excellent finish on cast-iron elbow with Finishing Room Foreman Royce Barrett.



Operators Joe Pettigrew (left) and Wayne Walker (right) removing fins and parting lines from cast-iron fittings for soil pipe. They report the Bay State wheels they are using show less wear than any others they have used in spite of the fact that their cutting speed is much higher.

BAY STATE ABRASIVES

BAY STATE
WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

helped Tyler Pipe lick a tough automation problem

These days, the very speed of automated production can turn out to be a headache instead of an advantage. In fact, a unique, automated pipe-casting process became just such a problem for Tyler Pipe & Foundry Co., of Tyler, Texas. Developed by Tyler's own engineering staff, the process enables the company to produce cast-iron pipe and fittings faster than any other known process or procedure.

The immediate result of this high-speed production was a serious bottleneck in the cleaning department where castings were finished. The snagging wheels in use simply couldn't keep up with the volume of work.

Rather than plunk a large investment into expanded facilities, Tyler's Purchasing Agent, R. S. Greenhaw, called in representatives of major abrasive manufacturers to see what they could do to break the bottleneck by boosting wheel performance alone. Among those called in was Bay State abrasive specialist Frank Jones who went over the whole snagging operation in detail. And the results paid off in substantially lower costs.

In plain figures, the Bay State wheel he recommended enabled the cleaning department to turn out over 20% more finished pipe and fittings per day than had ever been possible before.

All of which shows that Bay State's careful, analytical approach to grinding problems pays off in practical results. You'll find your own Bay State distributor and direct representative are equally well equipped by experience and thorough training to find practical solutions to your grinding problems. *Better grinding at lower cost... that is their business.*

Bay State abrasive specialist Frank P. Jones has not only had extensive experience in industry but has also had business college training. Consequently he knows which end of a balance sheet is up and says he figures that his business know-how makes his technical training doubly valuable. Proof of this claim lies in the first-class job he does for Bay State customers.

Circle 571 on Page 39

At Wagner Castings Co....

25% savings in shipping labor with Wirebound Pallet Boxes

Bulk handling speeds weighing and shipping of castings

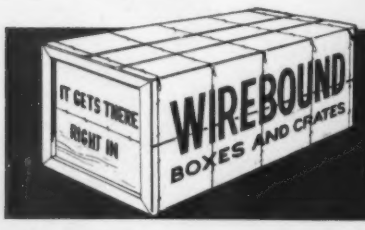
Savings of 25% to 30% have been realized by switching from bags and returnable wood pallet boxes to non-returnable Wirebounds at Wagner Castings Co., Decatur, Ill.

The time required to fill and tie bags, and the cost of returning wood pallet boxes have been eliminated. Even with their 1400-pound loads, these Wirebound pallet boxes stack safely three and four high on the shipping dock, conserving valuable space and speeding shipping operations.

Wagner's customers realize savings, too: handling is minimized—there are no bags to open, no boxes to return. Contents of the Wirebound pallet boxes are accessible for quick identification and for receiving inspection.

At Wagner, Wirebound pallet boxes loaded with malleable iron castings weigh in at about 1400 lbs.

You can realize similar savings by using Wirebound pallet boxes in your manufacturing, assembly and shipping operations. *Contact Wirebound box manufacturers for full information or write to the address below.*



WIREBOUND BOX
MANUFACTURERS ASSOCIATION INC.
222 W. Adams Street, Room 1468
Chicago 6, Illinois

1094

Calendar of MEETINGS

March 1-2—Malleable Founders' Society, Technical & Operating Conference, Pick-Carter Hotel, Cleveland.

March 11-14—Steel Founders' Society of America, annual meeting, Drake Hotel, Chicago.

March 20-24—American Society for Metals, Western Metal Congress & Exposition, Pan-Pacific Auditorium, Los Angeles.

April 9-13—American Industrial Hygiene Association, conference, Sheraton-Cadillac Hotel, Detroit.

April 10-12—American Institute of Mining, Metallurgical & Petroleum Engineers, Open Hearth Steel Conference, Sheraton Hotel, Philadelphia.

April 17-21—American Welding Society, Annual Meeting & Welding Show, Commodore Hotel and Coliseum, New York.

April 18—National Castings Council, annual meeting, Statler-Hilton Hotel, Cleveland.

April 18-20—Foundry Educational Foundation, annual college-industry conference, Hotel Statler-Hilton, Cleveland.

May 8-12—American Foundrymen's Society, Castings Congress, San Francisco.

May 9-11—Material Handling Institute, Eastern States Show, Trade and Convention Center, Philadelphia.

May 15-17—British Investment Casters' Technical Association, annual conference, London, England.

May 22-25—American Society of Mechanical Engineers, Design Engineering Show, Cobo Hall, Detroit.

June 5-7—American Society for Quality Control, annual convention and exhibit, Sheraton Hotel, Philadelphia.

June 8-9—Malleable Founders' Society, annual meeting, Broadmoor, Colorado Springs, Colo.

June 13-14—Connecticut Safety Society, annual meeting, Statler-Hilton Hotel, Hartford, Conn.

June 18-20—Alloy Casting Institute, annual meeting, Homestead, Hot Springs, Va.

June 22-24—Penn State Regional Foundry Conference, Pennsylvania State University, University Park, Pa.

June 25-30—American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

Sept. 18-20—Non-Ferrous Founders' Society, annual meeting, Shawnee Inn, Shawnee-on-Delaware, Pa.

Sept. 21—Cast Bronze Bearing Institute, annual meeting, Shawnee Inn, Shawnee-on-Delaware, Pa.

Sept. 24-26—Steel Founders' Society of America, fall meeting, Homestead, Hot Springs, Va.

Sept. 27-28—American Die Casting Institute, annual meeting, Edgewater Beach Hotel, Chicago.

Oct. 7-10—Conveyor Equipment Manufacturers Association, annual meeting, Ponte Vedra Inn, Ponte Vedra Beach, Fla.

Oct. 18-20—Gray Iron Founders' Society, annual meeting, Royal York Hotel, Toronto, Ont.

Oct. 19-21—Foundry Equipment Manufacturers Association, annual meeting, Greenbrier, White Sulphur Springs, W. Va.

Oct. 23-27—American Society for Metals, National Metal Congress & Exposition, Cobo Hall, Detroit.

Nov. 13-15—Steel Founders' Society of America, Technical & Operating Conference, Hotel Pick-Carter, Cleveland.

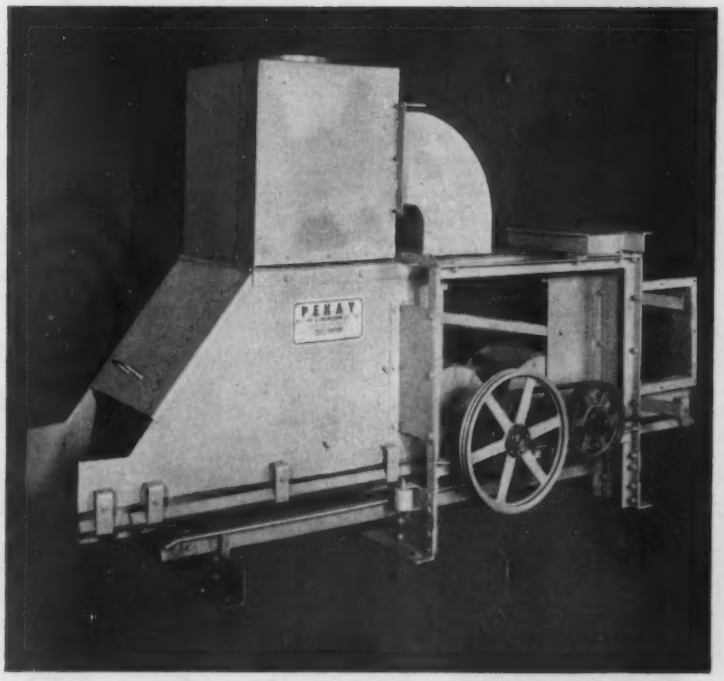
Nov. 15-17—National Foundry Association, annual meeting, Savoy-Hilton Hotel, New York.

Nov. 17-18—East Coast Regional Foundry Conference, New York.

Dec. 6-8—American Institute of Mining, Metallurgical, & Petroleum Engineers, Electric Furnace Conference, Penn-Sheraton Hotel, Pittsburgh.

Circle 572 on Page 39

Typical Pekay Coolerator with inspection door open. Capacity: up to 60 tons per hour.



COOL MORE SAND FOR LESS MONEY!

Pekay Coolerators

Cost Less to Buy

Cost Less to Install and Operate

Cost Less to Maintain

Pekay Coolerators effectively *lower* and *control* sand temperatures—at rates from 5 to 160 TPH—at a fraction of the cost of conventional equipment. Installed on your existing horizontal or inclined conveyor system, a Coolerator takes *no* floor space, requires *no* building or equipment modifications, is virtually maintenance-free.

Coolerator operation—uninterrupted as long as sand is fed onto the belt—reduces mixing time and insures precise sand quality control. And by cooling sand *before* batch or continuous mulling, Pekay Coolerators prevent your mulling operation from being compromised for cooling. You get the full benefit from your mulling operation.

Pekay Coolerators can operate in conjunction with your existing sand equipment or can be incorporated with Pekay Mixer-Mullers and Airators into a *continuous* start-to-finish sand conditioning facility. Either way, Pekay Coolerators are a money-saving investment.

For full information, fill in and mail the coupon, or contact Pekay direct.

PEKAY

MACHINE & ENGINEERING CO., INC.
2520 W. Lake Street • Chicago 12, Illinois

Pioneers and developers of continuous sand conditioning equipment for foundries. Used internationally.

I would like information on:

- ☐ Pekay Coolerators
- ☐ Pekay M-T-Matic Buckets
- ☐ Pekay Mixer-Mullers
- ☐ Pekay Airators

Name..... Title.....

Company .....

Address .....

City..... Zone..... State.....

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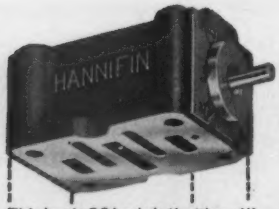
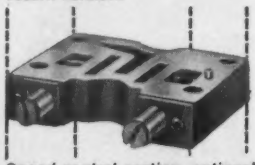


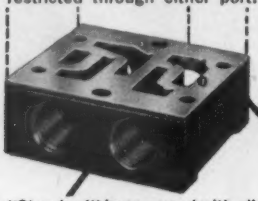
This basic CC body is the "heart" of every CC valve. Its one moving part is the "spool poppet", a Hannifin exclusive that seals bubble tight at either end of its short stroke. Note the ample air passages—all ¼" IPS or larger. This is single-actuator, spring return version.

This is the same body with double-end "spool poppet"—used when two actuators are required.



Speed control section, optional—designed to restrict exhaust flow, only, through either or both cylinder ports. Flow to the cylinder remains completely unrestricted through either port.

For foot-operated valves, the actuator is also the base, and this rear-ported adapter is used. Available tapped either ¼" or ⅜" IPS.



"Standard" base—used with all but foot-operated models. Every CC base is available tapped either ¼" or ⅜" IPS.

Optional base for "O" ring gasket mounting. Supplied complete with 4 O-rings.

"Universal" base, tapped from beneath and from both sides. Four pipe plugs supplied. Can also be used with O-rings.

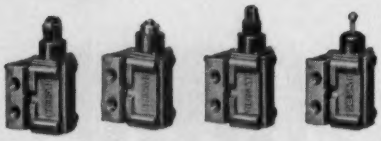
THESE QUICK-RESPONSE 4-WAY VALVES MOVE AIR DOWN THE LINE—FAST!

Hannifin CC valve design is the reason. Short, positive strokes of the "spool poppet" open up instant and ample passages for air.

Actuation? Any way you want it!

One basic body with a wide selection of operating heads and bases—all with or without our new speed control section—give you over 3,000 choices. We can help you make the right choice . . . through our field engineering service. Call your nearest Parker-Hannifin office or write us direct for full information.

SINGLE ACTUATORS
(Spring Return)

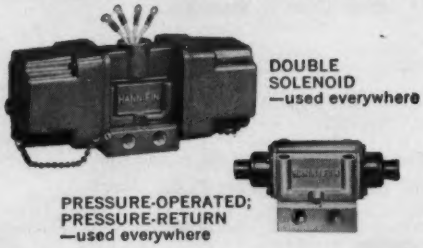


FIVE HAND VALVES

TWO FOOT VALVES

TYPICAL COMBINATIONS
(Hundreds Available)

FOOT-OPERATED, LOCKING; PRESSURE OVER-RIDE —used on foundry machinery
CAM-OPERATED; PRESSURE-RETURN —used on automatic wash tanks



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True economy is your prize in the long run when you choose from the comprehensive range of Vancoram Chromium Alloys—because there's one 'just right' for every job you do. And buying 'nearly right' just isn't right enough!

Vancoram Chromium Alloys meet specific needs for makers of stainless, heat-resisting, tool and constructional alloy steels, and for the foundry industry. Choose from high-, medium- and low-carbon grades, including EXLO,® a true ferroalloy with high chromium-to-carbon ratio. Vancoram Ferrochromiums and Ferrochrome-Silicons have a well-earned reputation for cleanliness and uniformity. Your VCA representative can help you select the composition 'just right' for you. Vanadium Corporation of America, 420 Lexington Avenue, New York 17, N.Y. • Chicago • Cleveland • Detroit • Pittsburgh

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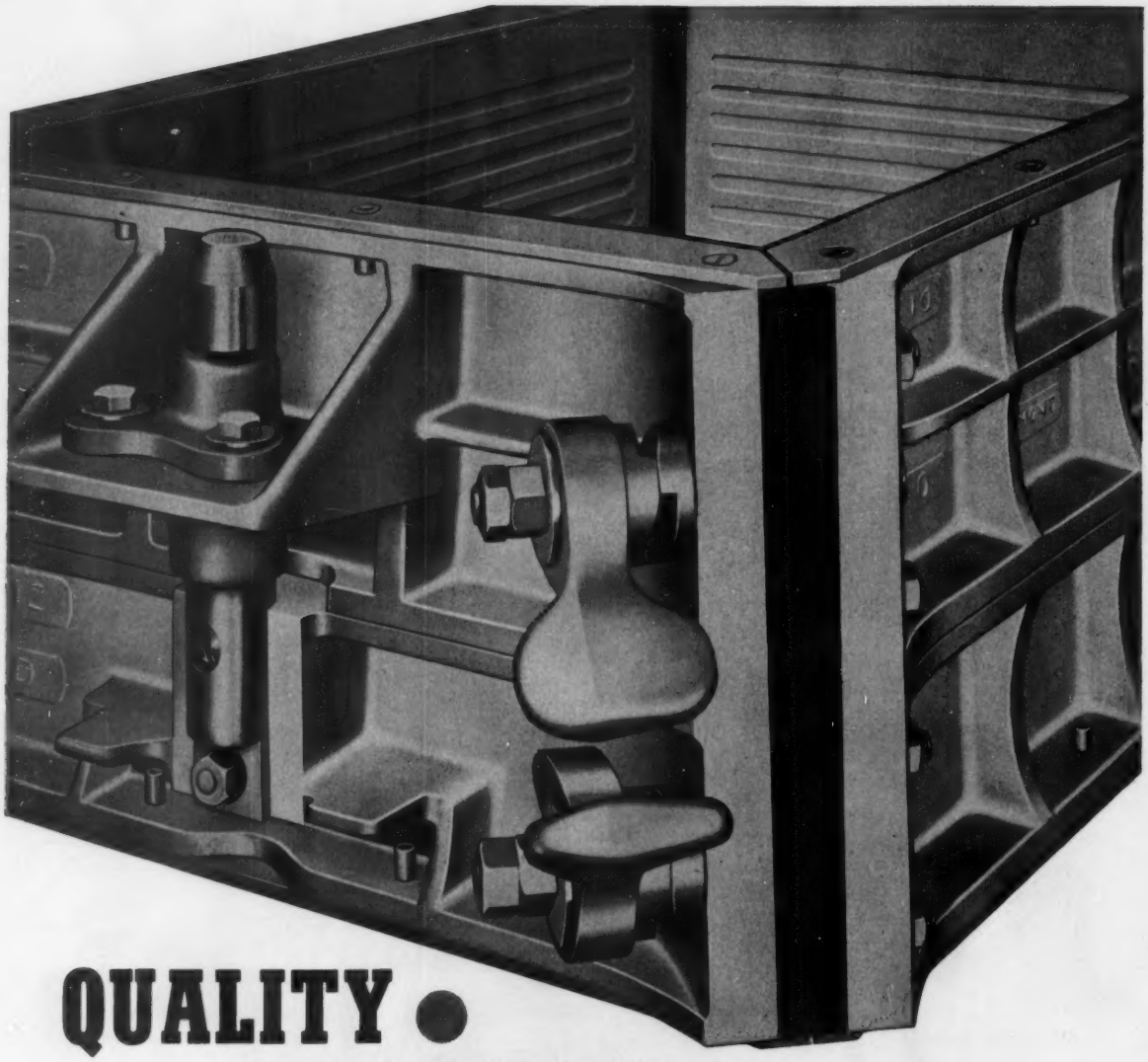
CORPORATION OF AMERICA
Producers of alloys, metals and chemicals



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That about sums up the story of Fremont flasks and jackets

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FOUNDRY

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Advertising content is classified by subject and listed by page number for your convenience when studying specific foundry applications. For further information on subjects advertised, refer to advertisement on the page indicated and circle Item Number on Reader Service Card —Page 39.

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Reader Information Service

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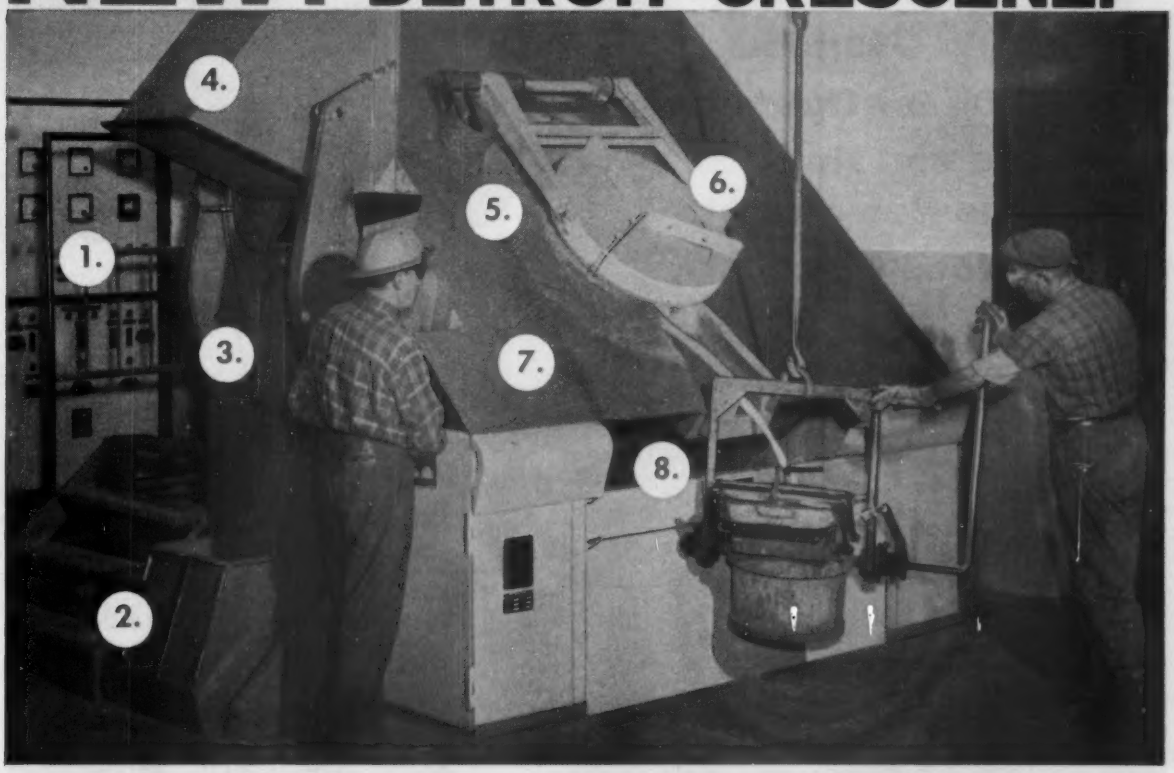
NEW! DETROIT-CRESCENZI



All the advantages of 60 cycle induction melting plus 8 MAJOR FEATURES:

The new Detroit-Crescenzi offers exceptionally clean melts, high power efficiency, exact alloy composition, even heat distribution and low-cost maintenance for iron and steel melting. It introduces many mechanical and electrical innovations new to induction melting. For example:

1 **More safety devices** and controls to keep closer watch on operating efficiency.

2 **Hydraulic skip charger** that loads at floor level, lifts and . . .

3 . . . **dumps** the charge into the crucible.

4 **Skip hood** to guide the charge into the crucible and confine the metal splash.

5 **Sectionalized coil and yokes.** Should a refractory failure lead to coil damage, only a portion of the coil has to be replaced.

6 **Hinged cover** that keeps heat in during melting and opens hydraulically for charging or inspection.

7 **Hydraulic lift** to smoothly tilt and quickly return the coil-crucible assembly to the melting position.

8 **All-steel construction** that permits removal of coil-crucible assembly without disturbing structural members or lifting mechanism.

Get more facts about the "all new" Detroit-Crescenzi CSA Coreless Induction Furnace. Write for bulletin 6113.

DETROIT ELECTRIC FURNACE

Division of Kuhlman Electric Co. • 11405 E. State Fair Ave., Detroit 34, Michigan

Circle 577 on Page 39

New from Wright!

Built-In Overload Protection for Operator, Load and Hoist with the New Wright Overload Cutoff*!

• Now, for the first time on any electric hoist, you can have safe, sure, mechanical overload protection as a built-in feature with the **WRIGHT Overload Cutoff.** Designed and built to fit any new WRIGHT *Speedway* Electric Hoist, the Overload Cutoff unit you see pictured above is a compact, integral part of the hoist frame itself. As a result, it becomes a functional part of the hoist *at no sacrifice in headroom.* The WRIGHT Overload Cutoff is simple in design and should give dependable, trouble-free operation during the entire life of the hoist under normal operating conditions. Calibrated and sealed at the factory for the user's protection, the unit takes rugged abuse up to the critical point of overload—then instantaneously "breaks" the raising circuit of the hoist. This allows the load to be safely lowered to the floor and unhooked. Once this is done, the raising circuit of the hoist is again automatically restored.

The WRIGHT Overload Cutoff is available now as standard equipment on all new WRIGHT Frame 2 & 3 *Speedway* Electric Hoists, and as optional equipment on new Frame 1 & 1½ models.

Find out how WRIGHT *Speedway* Hoists equipped with Overload Cutoff can bring practical, fast-acting overload protection to your material handling operations. For complete information, write our York, Pa., office.

*Patent applied for

See your WRIGHT Distributor *about the Speedway Electric Hoist line or write us for Catalog E-58*

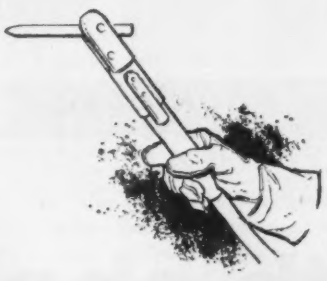
WRIGHT HOISTS

ACCO

Wright Hoist Division • American Chain & Cable Company, Inc.

York, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

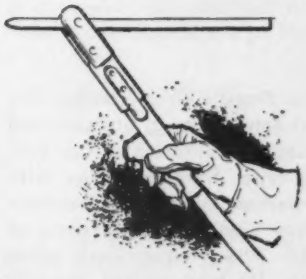
Circle 578 on Page 39



1.
This is the partially used Kostkutter Rod as it is held in the torch.

2.
Now the stub is ready for insertion of the new rod. Note that the stub is clamped far back and that the operator's hand is on the torch handle.

3.
Operator now joins new rod to stub by inserting tapered end firmly into hole and giving rod a slight twist. Pressure of torch jaws is sufficient to hold stub during seating—*do not use violent pressure or impact to drive in rod.*

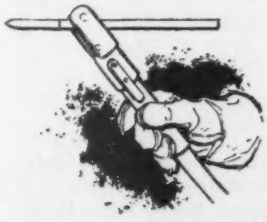


4.
New rod is now attached firmly to stub and ready for the first move.

get maximum savings from your

kostkutter* rods

Speer's new Kostkutter Rods are designed to save you 20-25% over conventional cutting carbons. Their revolutionary design allows new rods to be joined to stubs... virtually eliminating waste. Their use prolongs torch life, too, since the hot spot can always be kept a safe distance from the clamping device.
By following the simple procedures illustrated here, you can get maximum use and economy from your rods.



5.
This is the proper position of torch jaws after they are moved behind joint. This position also *keeps air blast off joint*—essential to prevent stub loss. The old stub should be burned to minimum length before moving torch jaws just behind joint.

Kostkutter Rods are copper-plated (except tapered sections) after shaping rod ends, thus insuring perfect contact between rods. Available only from Speer, Kostkutter Rods come in diameters of ½", ⅝", ¾" and 1". Standard cutting carbons are also available at slightly lower prices.

*Patent applied for

SPEER Carbon Co.
Carbon Products Division St. Marys, Pennsylvania

Circle 579 on Page 39

IMC A REPORT TO FOUNDRIES FROM TOM BARLOW

Clays with character

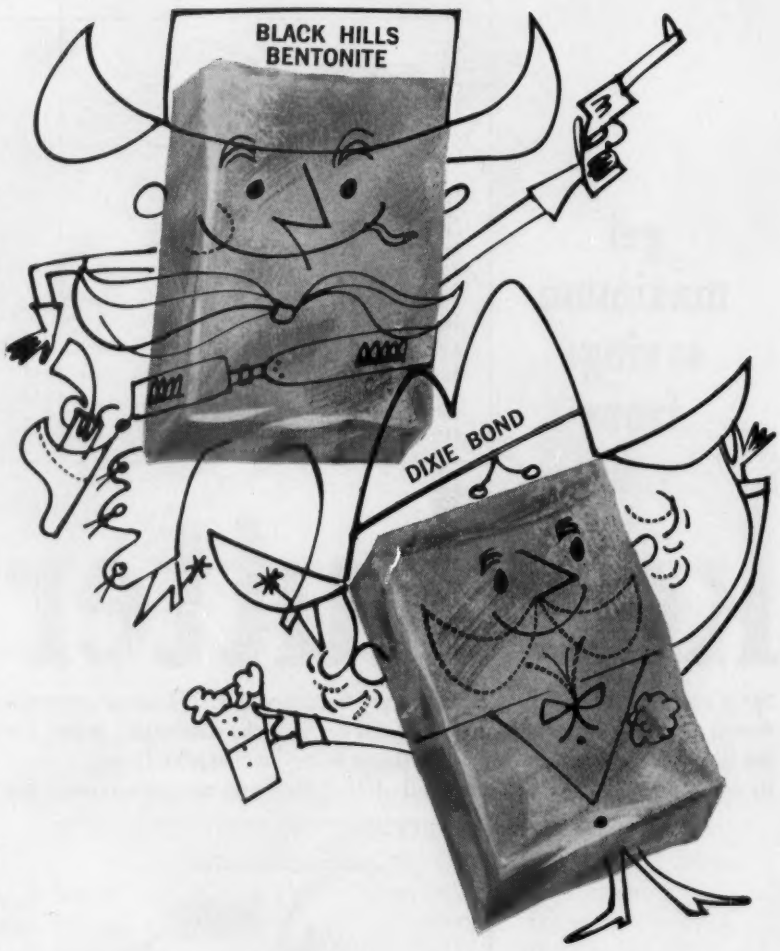
You might say that clays are like people — each one has a *character* like no other. Never let anyone tell you that the only difference is the hole in the ground they came from.

Take Black Hills Bentonite. It's an extremely strong, uniform and dependable bentonite of the Wyoming type. Here is a clay with lusty personality and a character that has won it a wide circle of friends. The reasons are plain enough: (1) highest dry strength combined with high resilience . . . (2) highest dry strength combined with highest hot strength . . . (3) highest dry strength combined with highest permeability.

And consider the need for resilience in sand — "bounce to the ounce." Of course, we're talking about a sand's degree of *yield* or *give* before breaking (called deformation). When you multiply the deformation value by the green strength, and a factor, the result is the sand value we call resilience. It is the *amount* of springiness or toughness possessed by a sand, and sands lacking this property are said to be brittle.

In this characteristic, Black Hills Bentonite excels over any other type of bond clay. It results in a sand that is *tough*. Less trouble is experienced with difficult lifts, and there is less breakage of corners and edge molds.

Now take green strength. Black Hills Bentonite yields very high green strength (although it is excelled in this respect by Dixie Bond). When we use it as specified, the result is high permeability, with a minimum amount of tempering water, and with less material to handle and less dead clay eventually left in heaps or to be removed.



And there's still more to this character analysis.

Dry strength: Black Hills Bentonite gives higher dry strength than any other type bond clay. This is insurance against cuts and washes, particularly in steel foundry practice.

For green sand or medium weight dry sand work, Black Hills Bentonite provides the highest dry strength per unit of clay used. (In making very heavy castings, however, fire clay binders such as Revivo Bond are usually selected because of the combination of high sintering point with adequate dry strength. But before our sermon degenerates into some kind of "Revivo meeting," let's move along to Dixie Bond, our second character study.)

The strongest bond since marriage was invented

Meet Dixie Bond. (Say "How y'all!") Unquestionably this is the strongest bond clay ever offered American foundrymen. As compared with bentonite, it has high green strength and permeability . . . high flowability and sintering point. Most important is its moderate dry and hot strength, which means easy shakeout with less lumping . . . easier knockout . . . reduced flask maintenance and fewer broken castings. Strong character? Dixie Bond really has it!

Tell me more, you say. (At least I hope you say.) Dixie Bond flows for accurate weighing and reduced hang-up in storage hoppers and feeders, together with improved pneumatic handling. Slurries flow because of minimum viscosity with maximum solids content.

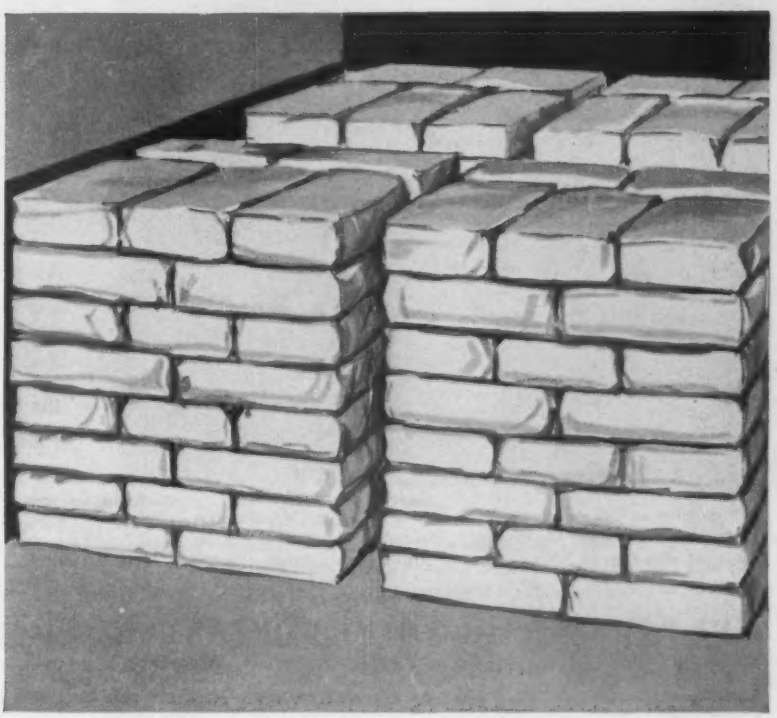
We're by no means suggesting that you start stocking your warehouse with Black Hills or Dixie Bond on the basis of what we've said here. These are only two of many Eastern Clay products that can make foundry sands behave.

Like we've been saying for all these years: no one bonding clay does all jobs equally well. Our service engineers are on the road constantly to assist customers in selecting the proper clay and in using it to their best advantage. These men know foundry conditions first hand . . . apply an extensive background in the study of bonding clays and synthetic sand. When your Eastern Clay service man advises you to try Black Hills Bentonite, Dixie Bond, or still another type additive, he knows whereof he speaks. And his counsel is impartial, as well as cost-free to you.

Why no other bentonites "stack up" with Eastern Clay

This seems a good time to get in a lick for our new *pasted* bags, since you'll find them used for both Black Hills Bentonite and Dixie Bond.

What can be said for a bunch of bags, you ask? Take a good look at the new ECP package. Neatly squared off. No sewn ends. No ears to tear in handling. They'll stack in your warehouse as firmly as bricks. And they need *less space.* That's one reason we say no other bentonites stack up with Eastern Clay. You'll find improved valve closure, too, to reduce leakage substantially. And ECP pasted bags are easier to pick up . . . easier to carry . . . less likely to break. Another advantage is that their design has enabled us to identify the contents on the end of the package, as well as on the body. So they even reduce the possibility of any confusion or error in the use of material.



EASTERN CLAY PRODUCTS

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

IMC

ADMINISTRATIVE CENTER, OLD ORCHARD ROAD, SKOKIE, ILLINOIS, YORKTOWN 6-3000

PRODUCTS FOR GROWTH*

*TRADEMARK

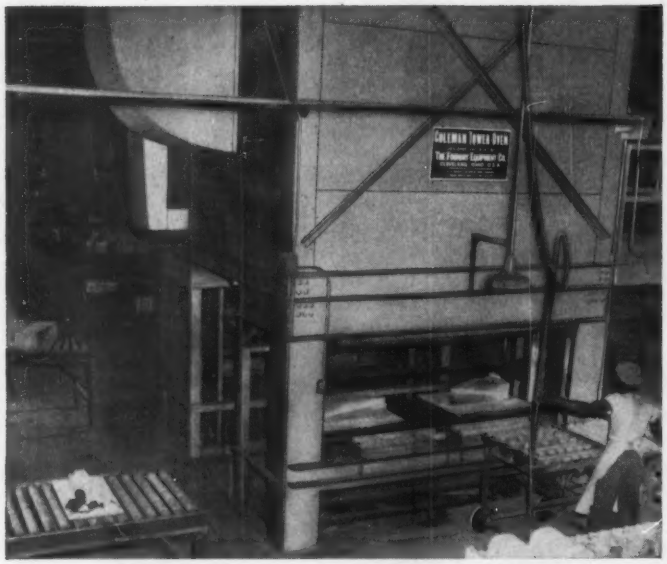
Circle 580 on Page 39

CUT LABOR COSTS

with

Coleman Dielectric Core Oven in leading plumbing fixture foundry. Direct labor alone reduced by 75%, with many other important savings and advantages.

Coleman Conveyor Core Ovens



Coleman Tower® Core Oven. One of two large installations in a major steel foundry. Mechanized handling and baking of cores up to 150 pounds at substantial annual savings.

● **Performance records in all types of foundries prove that Coleman Conveyor Core Ovens reduce core department costs by as much as 50%!**

Coleman Ovens quickly pay for themselves out of direct savings in labor, materials and reduced casting scrap.

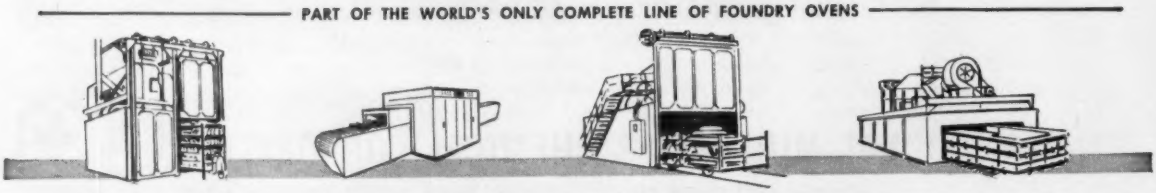
As builders of the world's only complete line of foundry ovens . . . dielectric or recirculating heat . . . we can recommend, without bias, the right oven for your particular needs.

WRITE FOR BULLETIN 54

THE FOUNDRY EQUIPMENT COMPANY • **1821 COLUMBUS ROAD, CLEVELAND 13, OHIO**

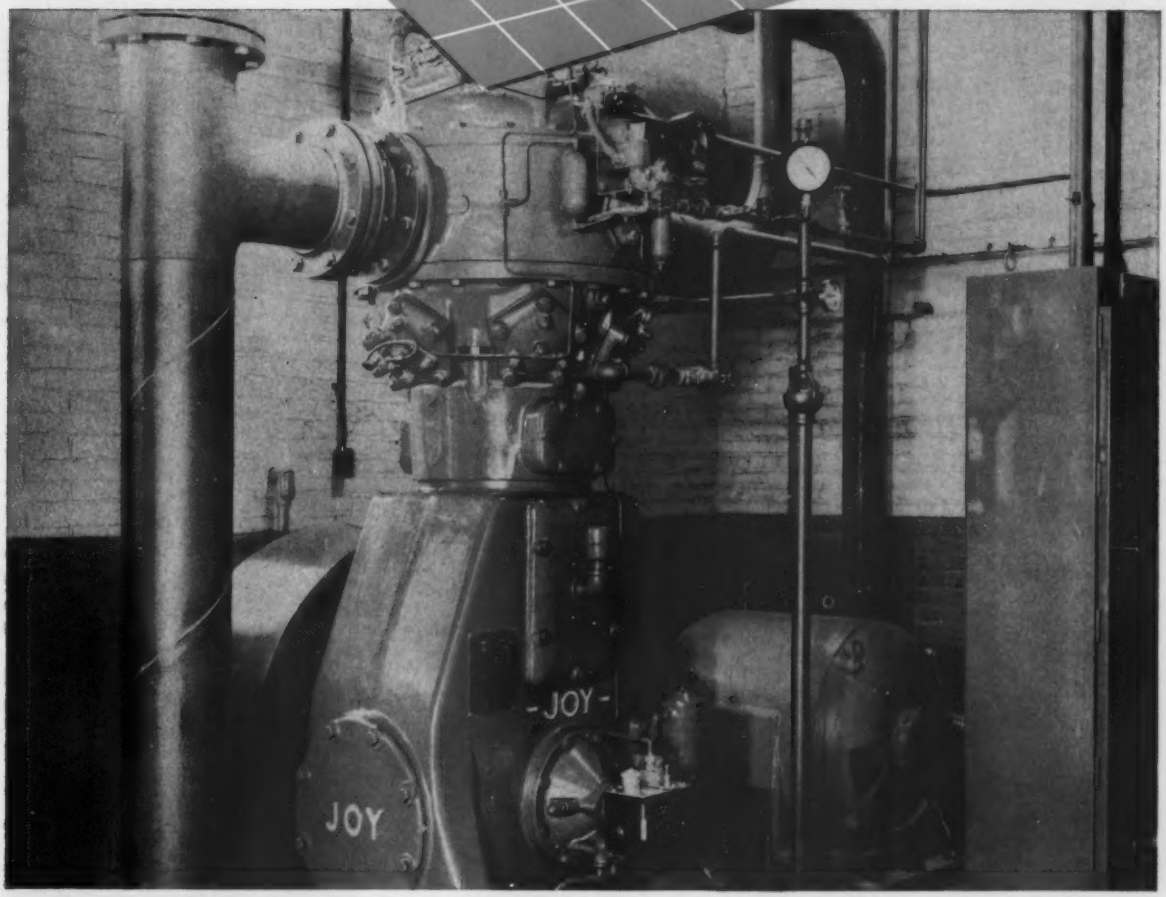
World's Oldest and Largest Foundry Oven Specialists—More than half a century of specialized foundry experience.

PART OF THE WORLD'S ONLY COMPLETE LINE OF FOUNDRY OVENS



TRANSRACK OVENS | DIELECTRIC CORE OVENS | CAR TYPE OVENS | JET ACTION MOLD OVENS

A 150 Horsepower Compressor in just 35 Square Feet of Floor Space . . .

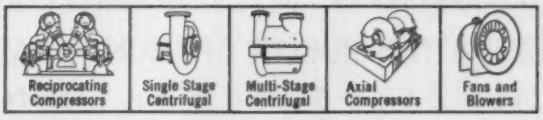


the JOY WG-9 Vertical Compressor

You can make full use of the space *above* the floor when you specify a Joy WG-9 vertical compressor. Thousands of these heavy-duty units have been installed in existing spaces which were too small for other compressors of comparable capacity.

Joy WG-9's are the only machines in their field offering so many "big compressor" features—replaceable cylinder liners and crosshead guides, anti-friction main bearings that never require adjustment, full force-feed lubrication of all working parts. These heavy-duty features mean dependable performance year after year. Eighteen standard models are available in a range from 15 to 150 horsepower, plus special models for high and low pressures and oil-free operation. One of them is just right for your next plant expansion. Get complete details by writing for bulletin 2414-13.

AIR MOVING EQUIPMENT FOR ALL INDUSTRY

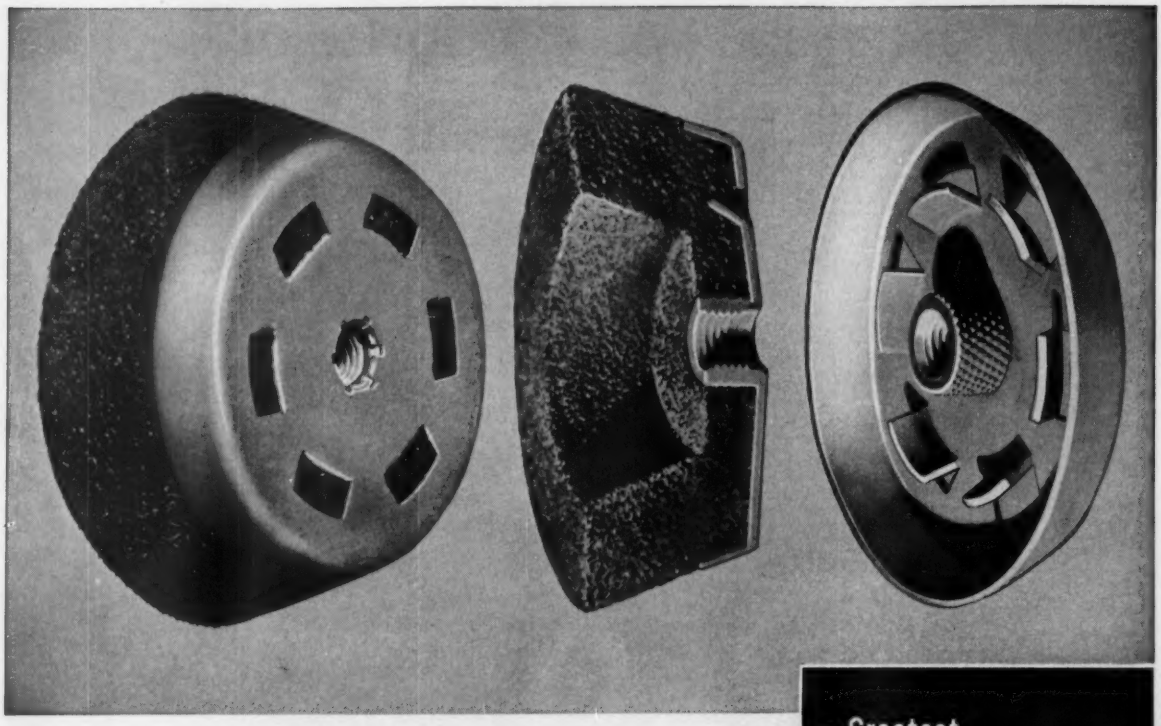


JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

Circle 582 on Page 39



MANHATTAN

THE ORIGINAL *SAFETY BACK* FLARED CUP

The first wheel to offer the exclusive features of the Safety Back Flared Cup! This totally new concept of design *and* construction puts portable wheel *safety* where it counts the most — in *original* strength and breakage resistance! With Safety Back, steel covers the entire back of the flared cup . . . extends down the side to assure a degree of reinforcement never before available with anchor bushings, safety rings, special hub mountings or ordinary revolving cup guards.

You can't get a safer wheel to use . . . and you can't find a better performing wheel to use on your portable grinders. Every Manhattan Safety Back Flared Cup is custom-bonded with the right abrasive for *faster* removal of *more* metal on your particular job — at no extra cost!

For faster cutting, longer lasting, *safer* abrasive wheel performance — "More Use per Dollar" — be certain you get the original Manhattan Safety Back Flared Cup. Let your Manhattan abrasive wheel engineer show you the exclusive advantages of this and other Manhattan high speed, heavy duty abrasive wheels. Write for Bulletin 7157.

- Greatest Initial Strength
- Easy Mounting — Easy Operation
- Highest Safety Factor
- Requires No Adjustment
- One Piece Assembly
- Improved Mounting Base

"MORE USE PER DOLLAR"

RM 1060

ENGINEERED RUBBER PRODUCTS . . . MORE USE PER DOLLAR

RM

WRITE TO ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION • PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

FANNER MANUFACTURING CO.
Specifying motor chaplets for your exact job, such as changes required by automation or thinner walls.
FOUNDRY CO.

CALL the FANNER MAN for CHAPLETS and CHILLS for SOUNDEST CASTINGS at LOWEST COSTS

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FANNER FEATURES

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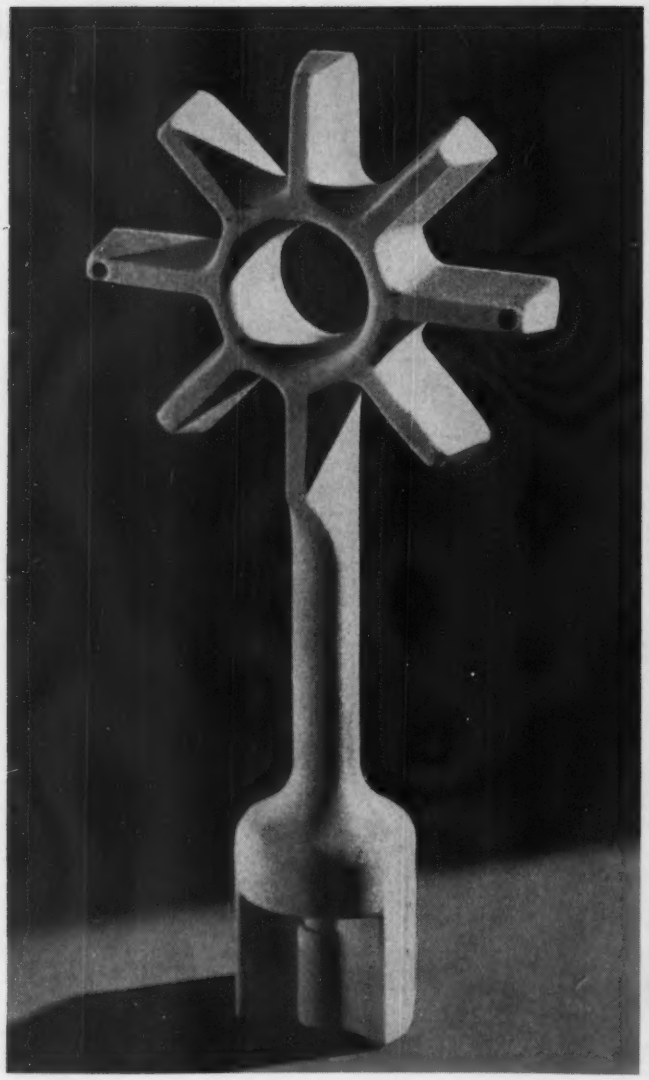
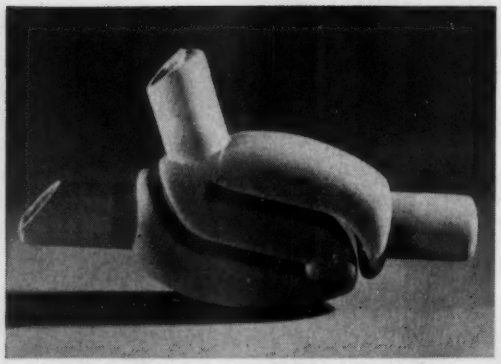
THE FANNER MANUFACTURING CO.

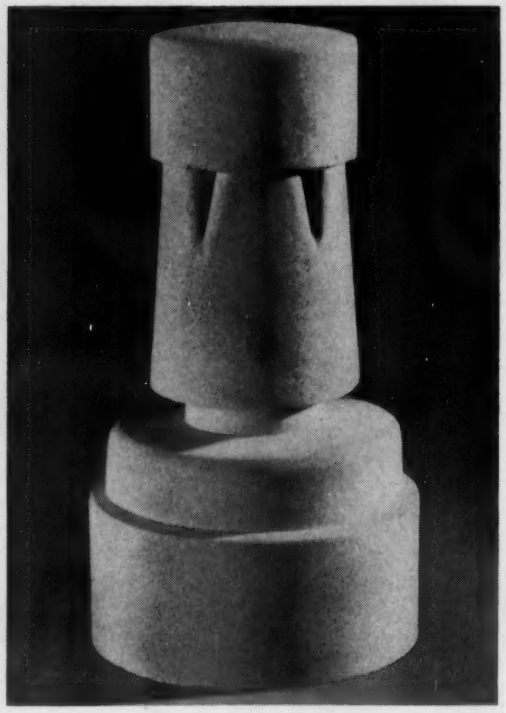
Designers and Manufacturers of Fine Fanner Chaplets and Chills

BROOKSIDE PARK CLEVELAND 9, OHIO

Circle 584 on Page 39





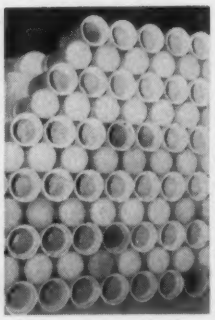


Foundry trims core costs by 1/3

More castings. Finer castings. *Castings that cost less to make.* That's the story in foundry after foundry where they're using shell cores bonded with Durez foundry resins.

Once it took sixteen men to make oil sand cores at Lake Erie Foundry Company, Inc., Girard, Pa. A switch to shell cores made it possible to move ten of these men into more productive jobs elsewhere in the foundry. The remaining six men now turn out more cores than ever—and that's only the beginning of this foundry's savings.

Easy to store. Cores now have smoother faces and come closer to specified tolerances. That saves costly machining. These cores can be piled up in stacks for storage—a big saving in space. They're much easier to lift and move than solid sand cores. They don't have to be baked; they come out of the core box ready for setting and pouring. Altogether, the shell cores now cost *one-third less* than before.



"Durez resin has played an important part in helping us make these savings," declares Ford Daugherty, superintendent at Lake Erie Foundry. "Its drum-to-drum consistency enables us to keep product quality high. Durez representatives have helped us make major savings by reducing resin content of our cores to a very low percentage."

You, too? Can shell cores help your foundry show results like these? Your Durez representative will gladly help you look into the matter. His know-how can save time and expense. See him soon.

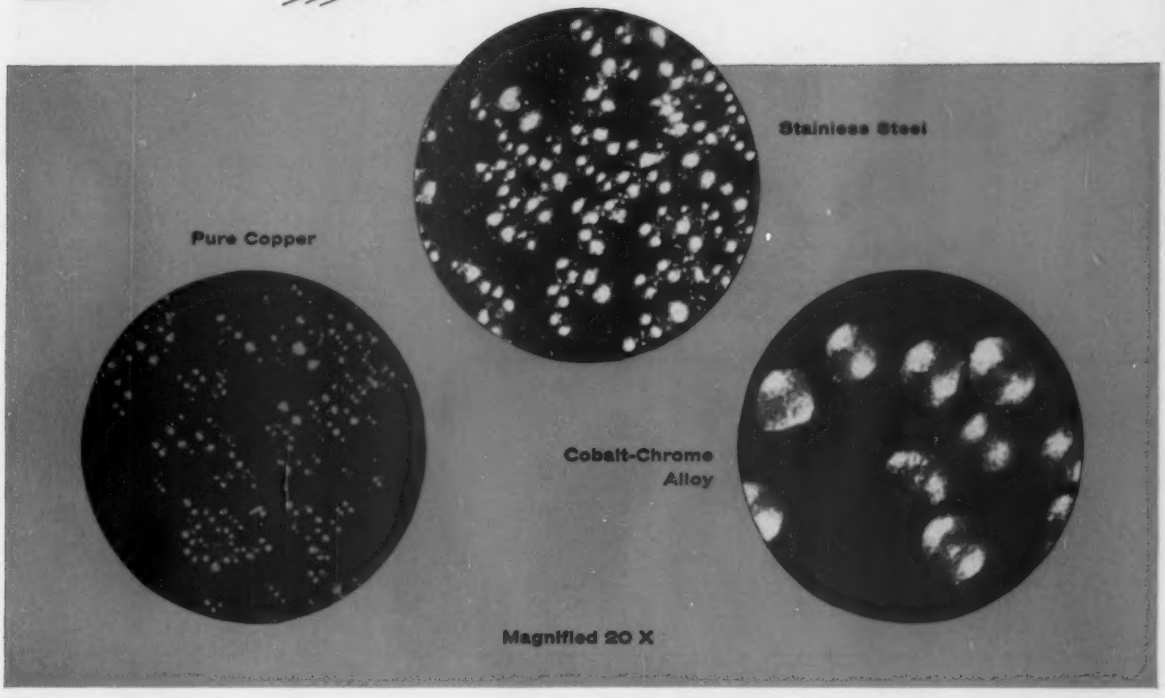
DUREZ PLASTICS DIVISION

HOOKER CHEMICAL CORPORATION, 1003 WALCK ROAD, NORTH TONAWANDA, N. Y.

HOOKER CHEMICALS PLASTICS

Circle 585 on Page 39

TOCCO Induction Melting provides precise control for new metal powder process



A new metal atomization process produces fine, pure, high-temperature metal and alloy powders of accurate particle size and shape. It was developed by Federal-Mogul Division of Federal-Mogul-Bower Bearings, Inc. at their Research Laboratories in Ann Arbor, Michigan.

A very important part of this process is the ability of the Tocco melting equipment to produce clean, molten metal, at the exact temperature required, quickly and efficiently. Three interchangeable Tocco melting furnaces used with the Tocco 100 KW 3 KC motor generator and furnace control provide the versatility necessary to enable Federal-Mogul to process many different metals without expensive, time-consuming change over.

Regardless what your metal heating problem is—melting, heating for forming, heat treatment—it will pay you to investigate Tocco application engineered induction heating.

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today— NEW FREE Bulletin

The Ohio Crankshaft Co. • Dept. F-3, Cleveland 5, Ohio

Please send copy of "The Case for Induction Melting"

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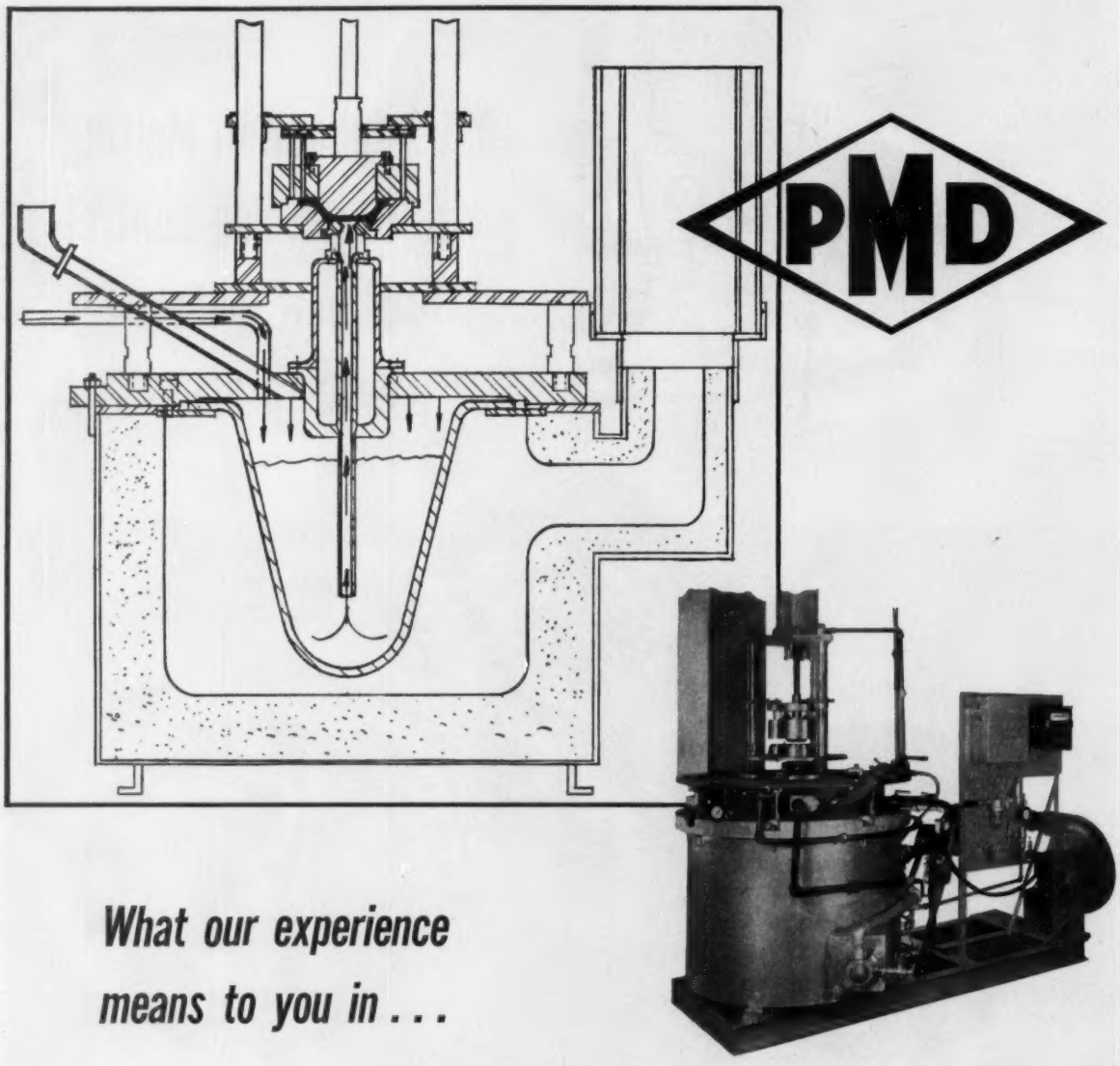
Circle 586 on Page 39



PMD

What our experience means to you in . . .

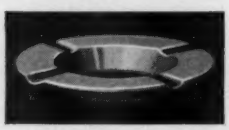
LOW PRESSURE CASTINGS

Low pressure casting is occupying an important place in the metallurgical industries as a major development in the technique of permanent mold casting. The success of this type of casting is due, in part, to the technical knowledge and manufacturing skill of the personnel at Permanent Mold Die Company. Their experience makes it possible for PMD to offer you the finest quality low pressure casting machines available. These machines assure close tolerances and reduced trimming operations.

The PMD low pressure casting process deviates from the standard method only in the introduction of the metal to the mold. The mold is placed above a pressurized, airtight furnace; the molten metal is then forced through a tube into the mold from below. Pressure is held just long enough for the metal in the mold cavity to solidify, then it is released, allowing the excess metal to flow back into the molten bath.

It is obvious that the gating system can be simplified and the risers can be reduced to a minimum. These PMD machines greatly increase the ratio of net casting to the amount of metal poured. This results in a substantial reduction in production costs.

Write today for more detailed information about PMD automated molding machines and the savings they can mean to you.



FINISHED PRODUCT OF ABOVE DIAGRAM

This ashtray is an aluminum casting made from the PMD low pressure casting machine shown above.

PMD

PERMANENT MACHINE DIVISION

A Subsidiary of Permanent Mold Die Co.

2275 E. 9 MILE RD. • WARREN, MICHIGAN

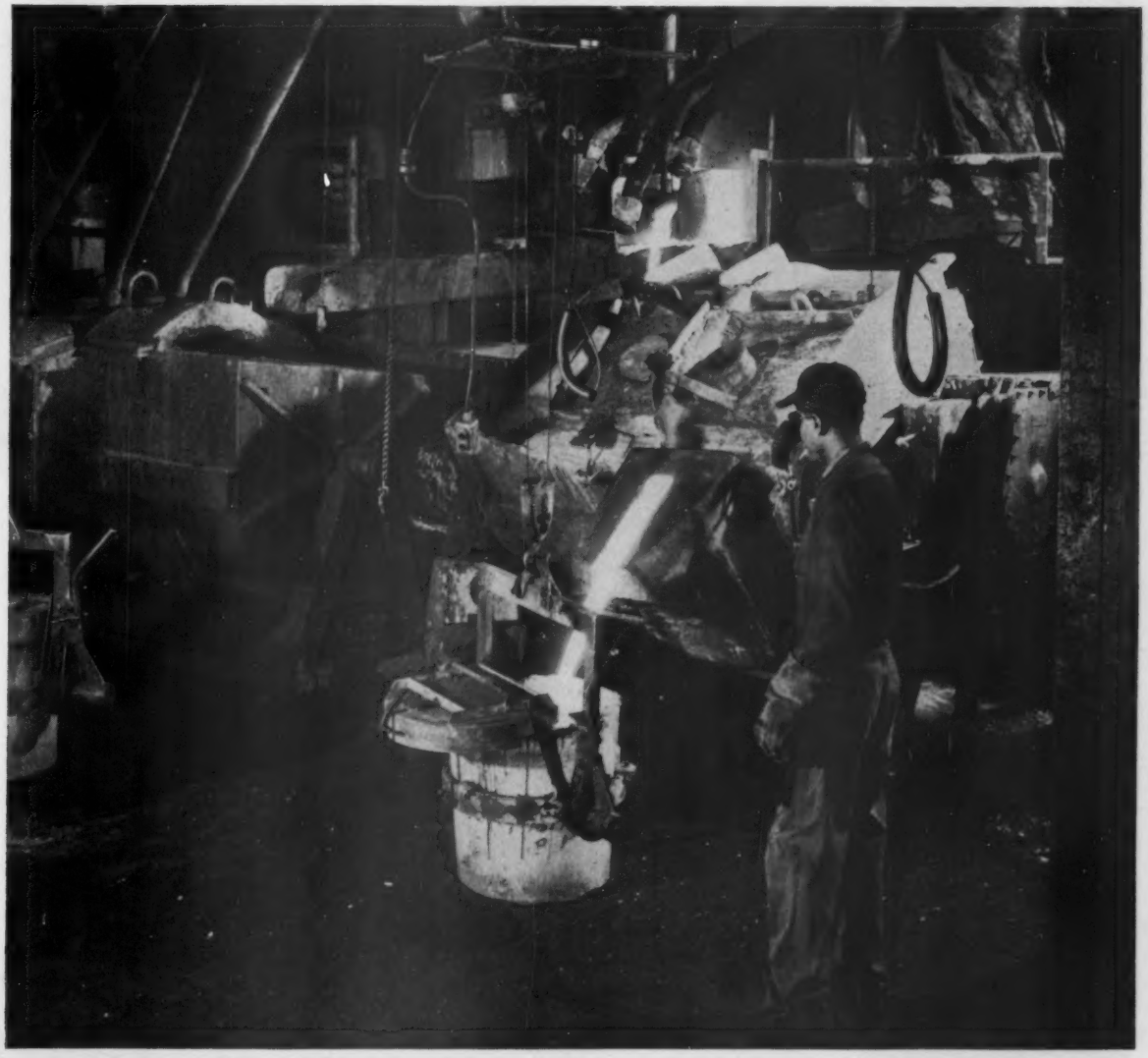
Circle 587 on Page 39

YOU POUR CLEANER IRON EVERY TIME . . .

if you use *Famous* CORNELL CUPOLA FLUX

for Gray Iron and Malleable Iron Foundries

A little Famous Cornell Cupola Flux, added to each cupola charge of iron, purges molten iron of impurities so that you pour clean metal every time. Furthermore, the iron is hotter, more fluid, and sulphur is greatly reduced. Many dollars are saved in cupola maintenance, too. Digging out is easier as drops are cleaner and bridging over is practically eliminated.



The CLEVELAND FLUX Company

1026-40 MAIN AVENUE, N. W. • CLEVELAND 13, OHIO

Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes . . . Since 1918

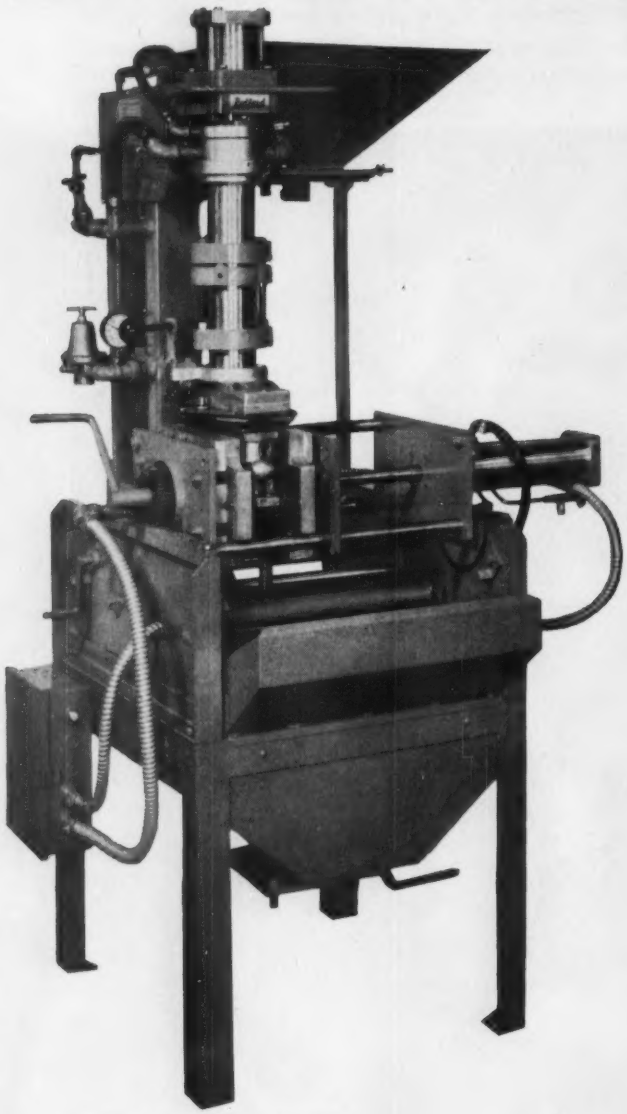
FAMOUS CORNELL FLUXES

Trade Mark Registered

Circle 588 on Page 39

Redford

MODEL HP-4
SHELL CORE BLOWER



A very fast low cost machine that is setting new standards in the production of small shell cores. The quality of intricate shell cores is improved because sand is blown into core box cavities through unrestricted blow holes. A novel cradle-type core box clamp is used to invert the core box and at the same time bring the core box within easy reach of the operator for core removal. There is no out of balance weight to struggle with. The machine can handle core boxes up to 10″ x 10″ in size. Shell cores may weigh up to 4 lbs., before draining.

The HP-4 Redford has ample blow capacity and can also be used to blow Furfural resin sand mixes into heated core boxes.

Price F.O.B. Detroit—$1,200.00
For complete information write for Bulletin HP-4

. . Above cores illustrate the variety of work that can be done with the Redford HP-4 Core Blower.

REDFORD IRON & EQUIPMENT CO.
20733 Glendale - Detroit 23, Mich.
Phone: KEnwood 1-8611

OTTAWA SILICA SANDS...

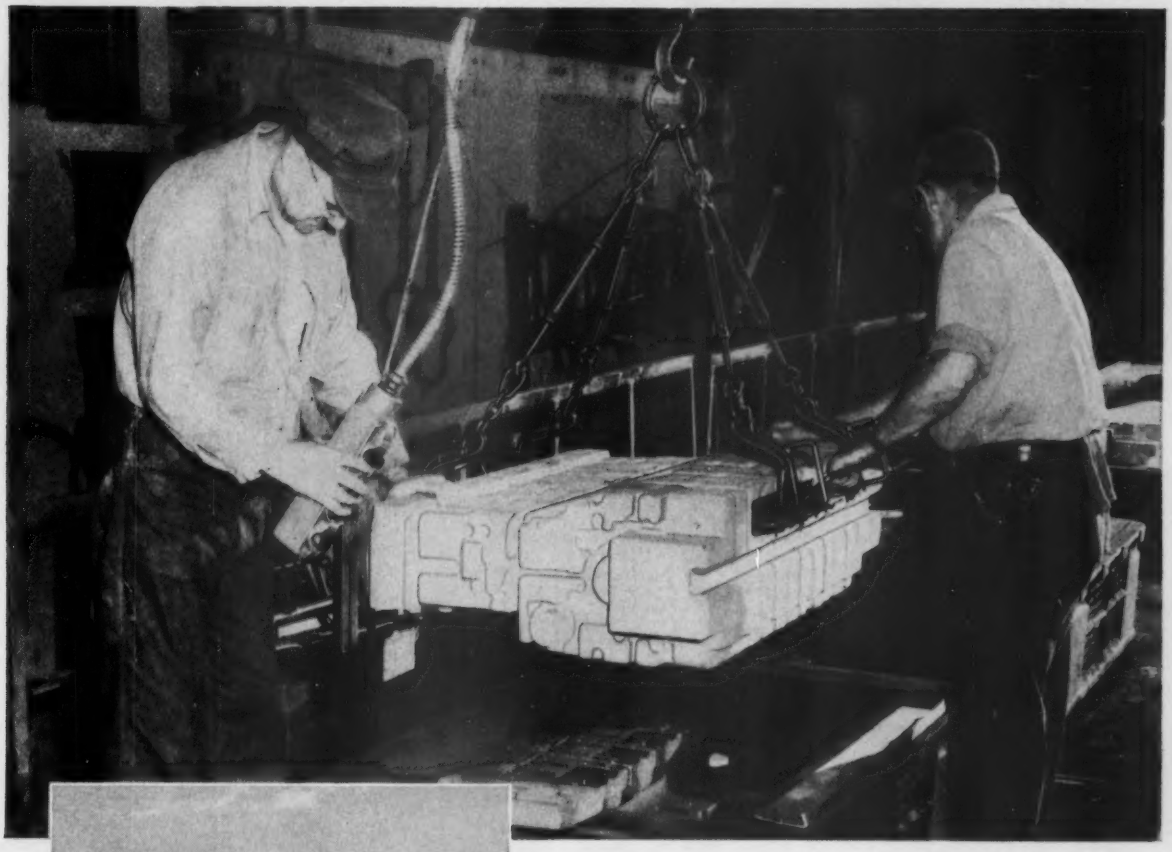


Photo courtesy of Caterpillar Tractor Co.

CORE SETTING STATION AT CATERPILLAR TRACTOR CO.
Cylinder block line, Peoria, Illinois plant.

Caterpillar Tractor Co. has used Ottawa Silica Sand for 30 years for these reasons: Availability — performance — cost. Caterpillar requires large tonnages of core sand and must have a dependable source of supply. Cores produced with Ottawa silica sand are uniform in hardness. Two important cost-saving factors are *low oil requirements and high reclaimability.*

Look to Ottawa Silica for . . .

- ROUNDNESS OF GRAIN
- FREEDOM FROM AGGLOMERATES
- GRAIN SIZE CONTROL, car-after-car.

Mail us your type of metal and size of casting section—we will be happy to send recommendations for grain size.

A Caterpillar crawler tractor FJP at work on trans-Canadian Highway, near Field, B.C., Canada (core of engine block produced with Ottawa Silica Sand).

99.9% PURE SILICA

Serviced by two main trunk railway systems, Ottawa Silica offers fast delivery to all corners of the nation.

OTTAWA SILICA COMPANY

OTTAWA, ILLINOIS

SUBSIDIARY PLANTS:

Standard Silica Co., Ottawa, Ill.
Michigan Silica Co., Rockwood, Mich.

SERVING THE FOUNDRY, GLASS, CERAMIC AND CHEMICAL INDUSTRIES FOR OVER 50 YEARS

Circle 590 on Page 39

pure nickel for critical alloying

When the specifications call for *pure* nickel, you can count on Sherritt as a reliable source of supply. Sherritt's unique hydrometallurgical refining process yields nickel powders with a purity of 99.9%. This high-purity nickel comes to you in handy briquettes and in three grades of powder for faster, easier alloying. The low chilling property of Sherritt briquettes and powders makes them particularly desirable for alloying additions at the end of the heat. Special nickel grades and coated powders are also available. FOOTE MINERAL COMPANY *is the exclusive sales agent for Sherritt nickel and cobalt in the United States and Canada. For complete illustrated brochure with prices and delivery information, contact the Foote Mineral Company, 473S Eighteen West Chelten Building, Philadelphia 44, Pa.*

SHERRITT GORDON MINES LIMITED

Circle 591 on Page 39

Circle 592 on Page 39→

To all metals Norton adds the first "Touch of Gold"

The term "precision-snagging" has yet to be invented – and the delicate touch is not a cleaning room technique. But snagging, the roughest, toughest, most basic type of grinding does benefit considerably by the "Touch of Gold" — built into all Norton grinding wheels to improve product quality and cut production costs.

Your operators, working on machines of any type or size, will like the easy, fast-cutting action of Norton snagging wheels. And *you'll* like the way they grind off more metal per dollar and turn out better work, bringing the true "Touch of Gold" to your production. See your Norton Man or your Norton distributor about test runs to determine exactly the wheels you need for best results on any metal. NORTON COMPANY, General Offices, Worcester 6, Mass.

NORTON
ABRASIVES

75 years of . . . Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Rejects CAN be reduced with the Alnor Pyro-Lance®

Test temperature below surface of metal in melting pot and pouring temperature in crucible.

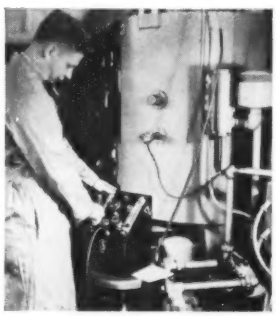
for testing of pouring temperatures of brass, bronze, tin, aluminum, babbitt, and other non-ferrous metals.

The Pyro-Lance with enclosed protected thermocouple will give submerged temperatures of molten metal in a few seconds. Exact pouring temperature assures even flow of metal in mould, resulting in a good casting. A rugged instrument with a working temperature range up to 2300° F. Price $97.00

Pyrocon®

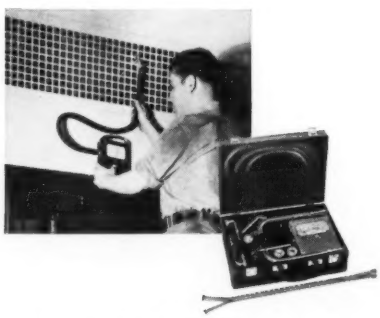
A surface temperature reading instrument. Will give almost instant temperature of die moulds, or any stationary surface. Thermocouples available for temperature readings of moving sheets, or rolls. Seven standard temperature ranges 0-300° F. to 0-1600° F. Price $125.00

Dew-Pointer®



Gives a fast, accurate determination of the dew point of gas atmospheres—for determining the carbon potential in heat treating furnaces during operation. Portable. Price $410.00

Velometer®



Air flow of exhaust systems can be read instantly in feet per minute. Range from 20 f.p.m. to 3000 f.p.m. and 6000 f.p.m. Price $194.00

Write for detailed specifications on these products

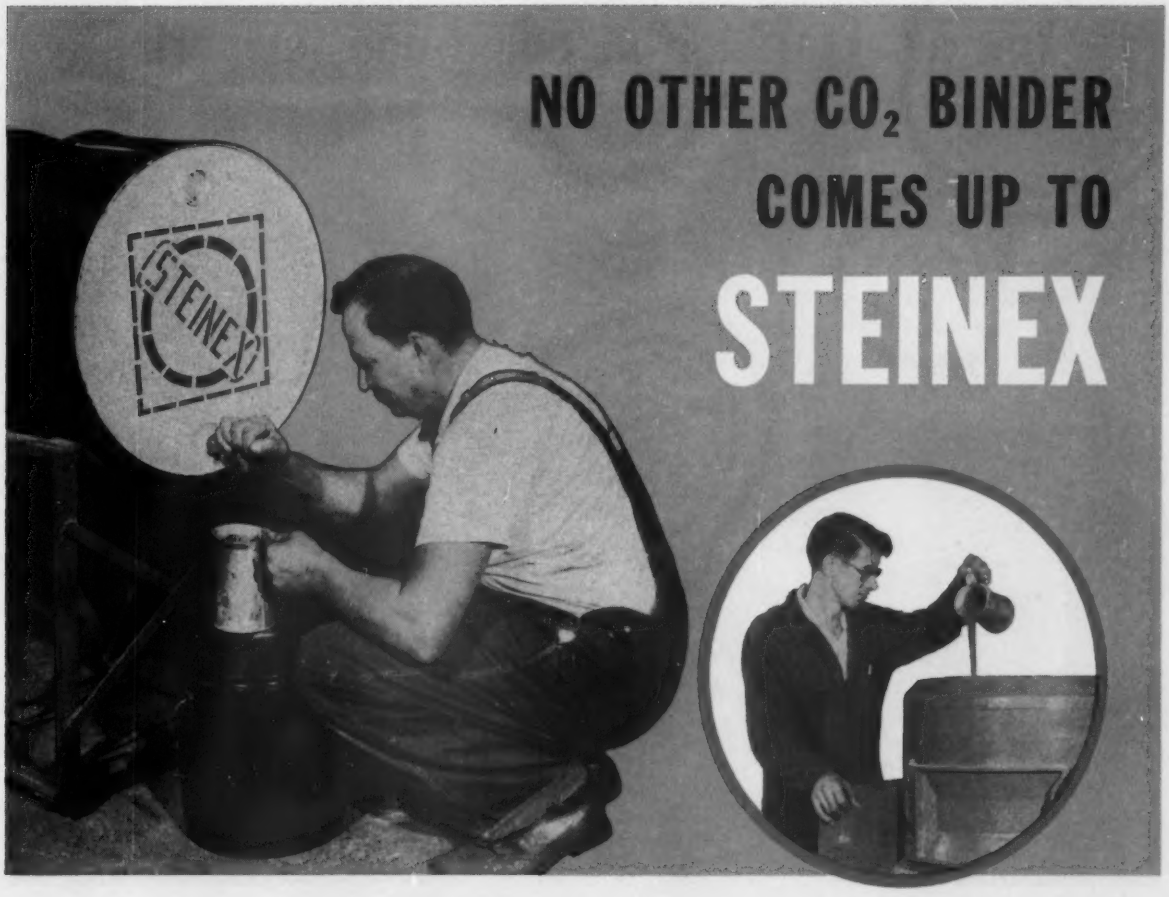
Alnor INSTRUMENTS

ALNOR INSTRUMENT CO.

Division of **Illinois Testing Laboratories, Inc.**

Room 511 • 420 North La Salle Street • Chicago 10, Illinois

Circle 593 on Page 39



NO OTHER CO_2 BINDER COMES UP TO STEINEX

The Original CO_2 Binder . . .
Available only from **CarVer**

BEST QUALITY

Steinex gives you absolutely the best shakeout — BY FAR!

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30% lower in cost than any other binder on the market!

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No one can give you more in-the-foundry experience and know-how than CARVER!

AND FOR BETTER CORES

KRAUSS Self-Cleaning Taper Slot CORE VENTS

Krauss Core Vents are knurled on sides to assure greater gripping power.
Underface — reinforcing rings prevent slots from closing when core vents are hammered into place.

MAIL TODAY

F-13

CARVER FOUNDRY PRODUCTS
Muscatine, Iowa

Please rush information and prices on:

- ☐ Steinex CO_2 Binders
- ☐ Krauss Self-Cleaning Taper Slot Core Vents

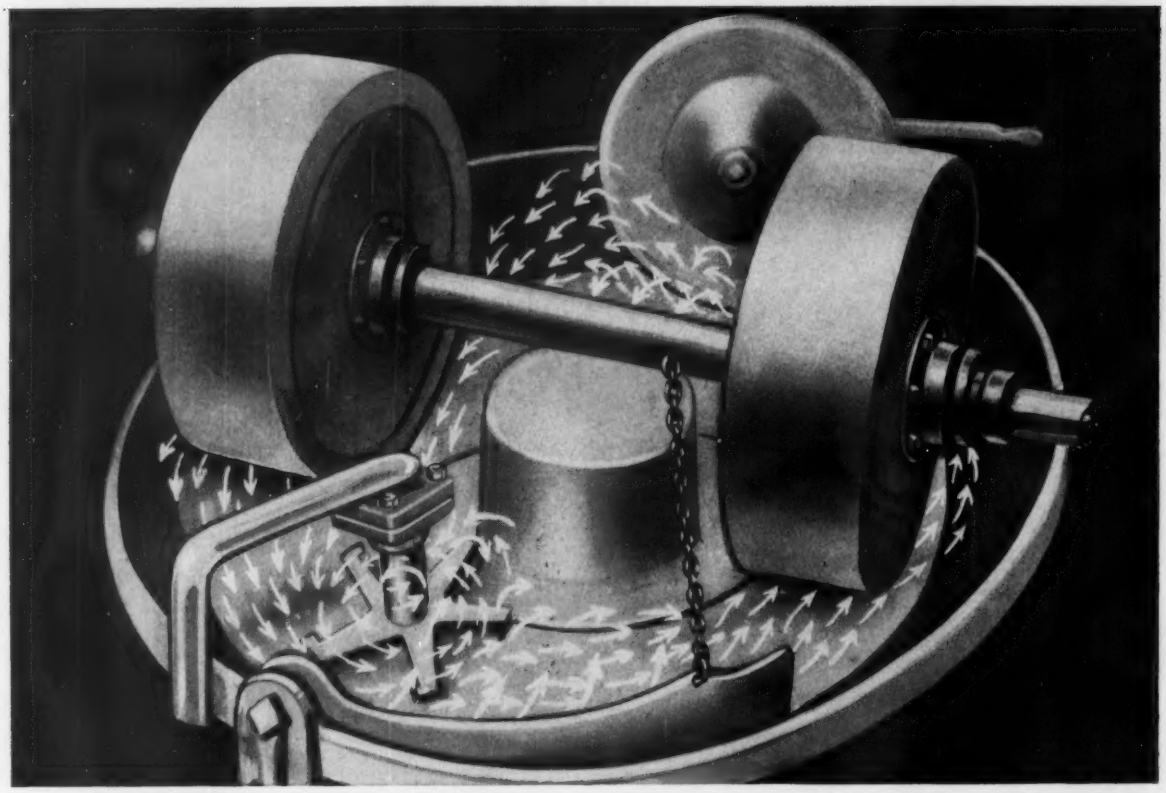
NAME _____ TITLE _____

FOUNDRY _____

CITY _____ STATE _____

Circle 594 on Page 39

You get thorough blending and tempering



with CLEARFIELD "Revolving Pan" MIXERS

All Clearfield Mixers work on the revolving pan principle, providing a balanced mixing and tempering action. As the pan rotates, centrifugal force keeps *all* of the batch in continual motion, adding to the mixing action of the mullers, agitator and revolving disc. There are no lags.

The mullers of Clearfield Mixers not only revolve on contact with the mixture, but also exert a sliding, twisting action which rubs or "smears" the bond on the sand grains, increases the speed and thoroughness of tempering. These mullers are wide faced and spread far apart to give maximum mulling area per revolution . . . high production is achieved without excessive pan speeds, reducing vibration, prolonging life of the machine.

The patented star-shaped agitator of Clearfield Mixers covers the entire flat surface of the revolving bottom and prevents the material from forming hard cakes or lumps. The agitator is driven by contact with the revolving bottom or the material being mixed. The whirlpool action created by the agitator speeds up the mixing process, promotes clean emptying of the pan.

A double duty disc cuts all the material free from the revolving pan rim at each revolution, turns it over and diverts a continuous stream of material under the mullers. When moved to the discharge position it unloads the complete batch within 15 to 30 seconds! This discharge, in addition to being smooth, rapid and clean, has the important advantage of having an aerating effect because it shoots the sand out over the rim into the hopper in a finely diffused spray, depositing it in a soft fluffy condition ready for use.

There's a size for every job

Clearfield Mixers are available in sizes from 2½-ft. to 9-ft. diameter . . . with capacities per batch ranging from ½ cu. ft. to 40 cu. ft. For details write for free technical bulletins.

CLEARFIELD
MACHINE COMPANY
CLEARFIELD,
PENNSYLVANIA, U.S.A.

Circle 595 on Page 39

She gets the job done, but...

You know this gal. She can "fix anything with a hairpin", so she's never learned to use better tools and techniques. Some foundries are like that, too — highly capable, but . . .

Frankly this is *one* of the reasons why Logan can report such dramatic results from its Plant Dynamation conveyor systems. A foundry's engineers sit down with "The Man From Logan" and analyze the basic dynamics of their plant. From that point the Logan specialist has the techniques, foundry experience, and complete line of conveyors to develop the *one right* system.

The system that paces a plant to its real capacity —full *dynamation*— pays for itself fast. And it helps put operation on the most profitable basis for years to come.

Phone or write for a visit from the Logan Plant Dynamation engineer stationed near you. If you plan to build or remodel, remember— the earlier you call in this specialist, the more you benefit.

Logan Plant Dynamation design helps you harness all the work-power of your plant

Logan Conveyors

LOGAN CO., 581 CABEL ST., LOUISVILLE, KY.

Circle 596 on Page 39

YOU'LL DO A BETTER JOB

with **H. V. ADAMS DESIGNED**

HIGH EFFICIENCY FOUNDRY TOOLS

"UNIVERSAL FREE WHEELING"

FOUNDRY SAND RIDDLE

with the Double Eight Vibration

Because of its convenient size, light weight and good riddling capacity it long has been a favorite in the foundry. It also can be used for mixing core sand or for sifting sand directly into molds.

The mechanism is entirely enclosed protecting it from harmful dust and grit.

The main frame is cast in very strong tough aluminum.

It uses quick change ferruled sieves with 20 in. diameter sifting area. There are no loose wires to harm hands.

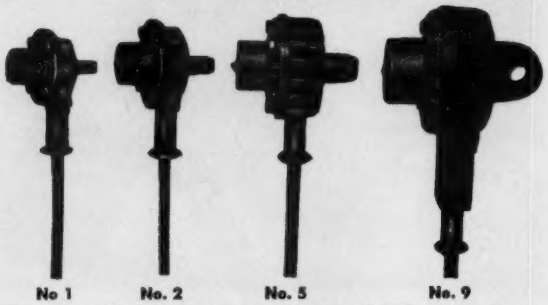
THE "ROTOPLANE" SPEED SIFTER

WILL GIVE YOU

- **SPEED**
- **ECONOMY**
- **SAFETY**
- **LONGER LIFE**
- **GREATER SIFTING CAPACITY**

Its sturdy one-piece frame and long shaft add to vibration effectiveness. The sealed-in mechanism assures protection of motor and bearings from exposure to dust and grit. This sealed in protection and "Rotoplane's" free-rotary action vastly increase bearing life. No exposed moving parts endanger the operator. Sieves have 20 inches diameter clear sifting area—are mounted in a smooth steel ferrule with no jagged edges to cause dangerous cuts and scratches.

"RED (Devil) ELECTRIC" VIBRATORS



No 1 No. 2 No. 5 No. 9

These hard hitting Adams designed Vibrators have served the foundries for over 30 years. They are provided with a 6 foot 3 wire authorized cable and 3 wire grounded connector which, when connected with our 3 wire grounded Red Electric Knee Switch, automatically grounds the vibrator protecting the worker from shock. The vibrators have passed the U. S. Government code inspection.

Other Foundry Products:

- **No. 11 NOISELESS TYPE VIBRATOR**
- **A-20 ELECTRIC VIBRATOR**
- **RED ELECTRIC KNEE SWITCHES**
- **"ROTO" ADJUSTABLE BIN VIBRATOR**
- **2 MIN. UNIVERSAL FINENESS TEST SIFTER.**
- **UNIVERSAL TRIPOD CARRIER**

ORDER ALL SIFTERS AND VIBRATORS WITH GROUND WIRE!!

FOUNDRY SUPPLIES MANUFACTURING CO., NOT INC.

2221 Orchard Street - Chicago 14, Illinois

Circle 597 on Page 39

Circle 598 on Page 39→

"P-L-E-A-S-E, Dear Koppers..."

That guy Satan is a persistent devil all right. He's called a dozen times begging to buy some of our Koppers Premium Foundry Coke. It's kinda hard to keep saying no, because *he* says business is good down there and he wants to place a big order.

But business is good up here, too. Apparently the word has been getting around that Koppers Foundry Coke keeps operating costs way down and maintains a higher temperature range.

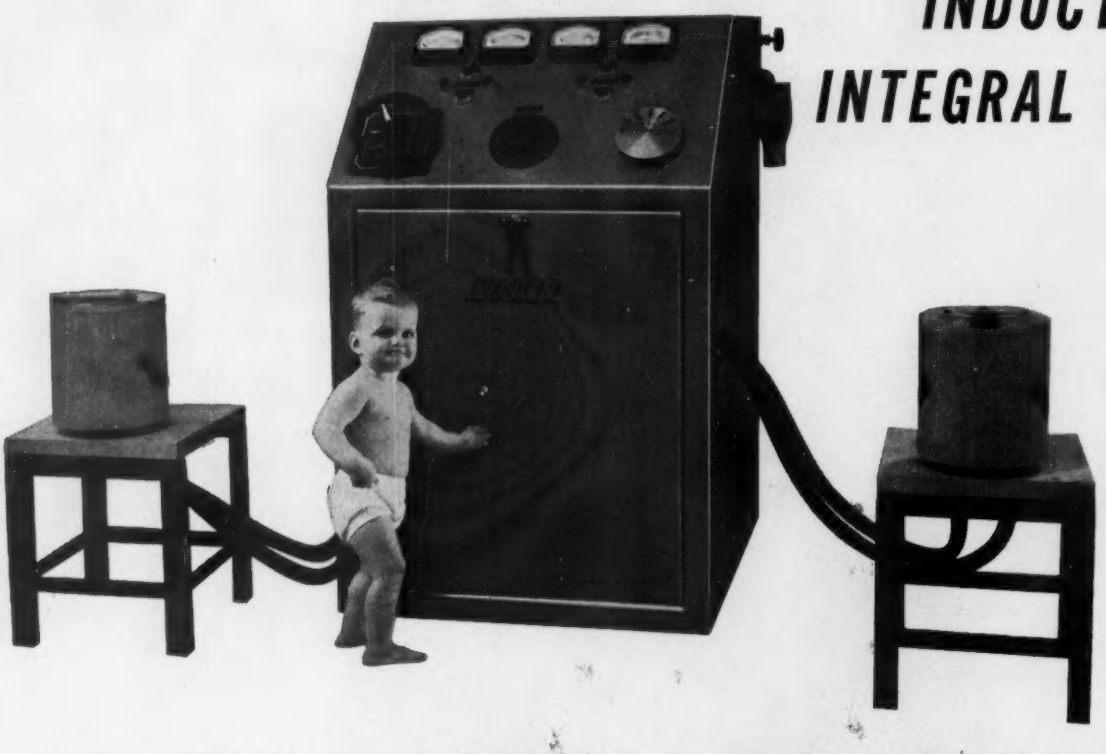
The reasons are these: Koppers Coke is prepared from the best quality West Virginia coals, carefully blended and baked the right length of time. It's absolutely uniform in *size, strength, structure* and *chemical analysis.* We check each day's run to be sure.

And because of its superior physical qualities, high carbon and low ash, Koppers Coke enables foundrymen to maintain higher temperatures which increases the cleanliness of the iron and helps to reduce fuel consumption.

No, we're still not going to sell Brother Satan—but we'd sure like to sell you. Why not make your next order Koppers Premium Foundry Coke? Available anywhere in the U.S. or Canada, it's sized to fit your needs. Koppers Company, Inc., Pittsburgh, Pennsylvania.

Koppers Premium Foundry Coke

Meet our new baby giant... *the M-G Powered INDUCTO INTEGRAL 15*



... you'll never again be satisfied with Spark-Gap Melters

Inductotherm now offers the greatest space-saving, most economically-operated induction melting system in history. Once you've compared the Inducto Integral 15, you'll never be satisfied with a spark-gap converter. What's more, the 15-kilowatt Integral 15 has the same melting capacity as 20-Kw spark-gap units.

Compare Installation The entire unit occupies only 35" x 40" of floor space. The motor-generator, capacitors, transformers, and all controls are packaged in a single, compact console. Completely pre-assembled and pre-tested before delivery . . . all you do is tie-in power and water lines and you're ready to start melting. Radio shielding problems are eliminated.

Compare Operation Whatever your melting problem . . . in small foundries, in research laboratories . . . you achieve optimum power for fast, efficient melting with minimum metal loss. In addition, the Integral 15 easily maintains a balanced 3-phase load . . . you can connect two furnaces to one power control . . . and it's readily adapted for vacuum melting.

Compare Maintenance No more hydrogen to purchase, store, feed, and dispose. Moreover spark-gap converters operate at extremely high voltages with peaks up to 20,000 volts, while the Integral 15 operates at a constant 220 or 440 volt coil voltage. Safety factors increase, . . . arcing problems drop almost 99 percent. Costly mica insulation between coils is eliminated. In fact, the *only* maintenance needed is routine lubrication.

Compare Cost The Integral 15 costs a little more than spark-gap units. But you start saving money the minute you start operation . . . in time, metal, maintenance and power consumption. You can amortize the cost differential in a matter of months. And your savings are the same whether you purchase an Integral 15 outright or use Inductotherm's unique rental or lease-purchase plans.

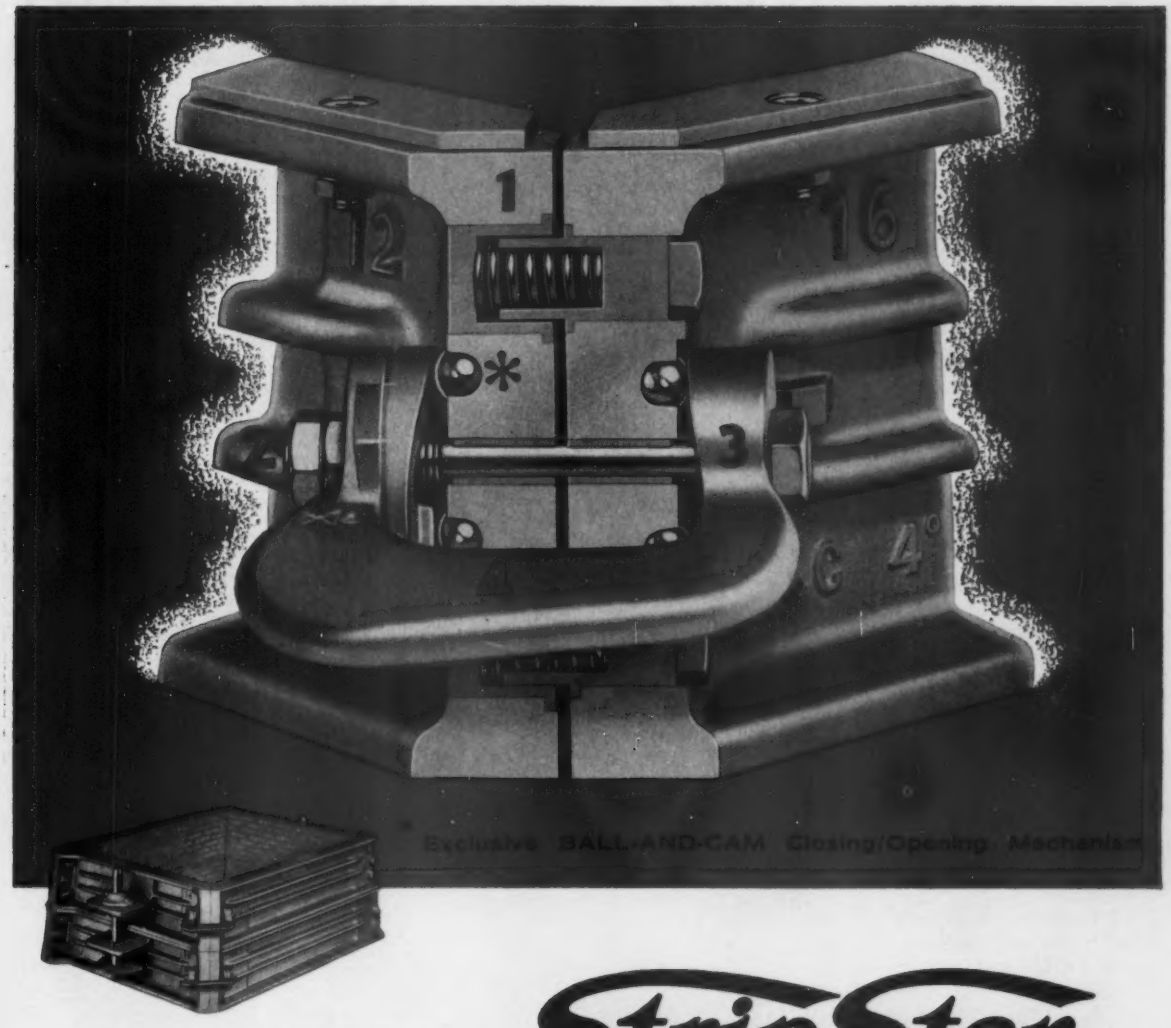
Compare the Facts We'll gladly send you complete details on the Integral 15. Write for Bulletin 20-15. Other Inducto "Integral" models available with capacities of 30, 50, and 100 Kw. Address: Inductotherm Corporation, 412 Illinois Avenue, Delanco, New Jersey.

INDUCTOTHERM

Special Trade-In Offer

Realizing that the Integral 15 obsoletes many spark-gap units just a few years after purchase, Inductotherm plans to share this early obsolescence with their customers by offering a trade-in allowance of 50% of the original purchase price of 20 Kw Inducto spark-gap converters toward the purchase of the new Integral 15. This offer applies only to ***original*** *purchasers of 20 Kw Inducto Melters and may be withdrawn at any time.*

New Snap-Flask Locking Device...



THE STERLING StripSter

The New Sterling StripSter offers precisely the advantages you want for your flask operations . . . ease of use, speed with quality production, minimum servicing. Whatever your requirements . . . single or double pin closing, hardened steel bushings, handles, trunnions and upsets . . . the Stripster fills every need more efficiently.

Your Sterling representative will be glad to show how you and your foundry will benefit.

1. Shielded-spring sleeve design eliminates frequent lubrication and servicing.
2. Floating Cam provides easy 1-Point Servicing.
3. Easy operating Split Cam produces maximum opening.
4. Broad-faced handles assure instant, positive opening/closing.

Sterling WORLD WIDE SERVICE

STERLING NATIONAL INDUSTRIES, INC.

MILWAUKEE, WISCONSIN • ASSOCIATE: STERLING FOUNDRY SPECIALTIES LTD., LONDON • BEDFORD • JARROW-ON-TYNE, ENGLAND

THE LITHIUM REACTOR

CURRENT INFORMATION ON LITHIUM CHEMISTRY AND METALLURGY

TROUBLE SHOOTING COPPER MELTS WITH LITHIUM CARTRIDGES

The addition of lithium in trace amounts to copper results in a number of outstanding improvements. First, it removes oxygen and other dissolved or occluded gases to produce dense copper castings without porosity and with improved conductivity. Secondly, it improves the fluidity of the melt to assure complete filling of intricate molds, easier handling, and fewer inclusions. Thirdly, it improves the grain size of the metal, thereby contributing to better workability and corrosion resistance.

To simplify the use of lithium, LCA developed the "lithium cartridge," a hermetically sealed cylinder of 99.9% pure copper filled with weighed amounts of pure lithium metal. Since the use of the cartridges does not materially alter customary foundry practice or require special equipment, they have found rapid acceptance.

The cartridges are furnished in four different sizes containing, respectively, 2.25, 4.5, 9, and 108 grams of lithium to treat anything from approximately 50 lbs of copper up to about 2400 lbs at one time.

To facilitate immersing the cartridge in the melt, LCA has developed the LCA Lithium Cartridge Applicators. These are essentially graphite rods, bored to hold the appropriate number of cartridges. Applicators are furnished in three models: G-1, G-2 and G-3. Type G-1 handles most required quantities of lithium from 2.25 grams to 40.5 grams. The G-2 can be used for 2.25 grams to 256.5 grams. The G-3 is designed for use with small-quantity experimental melts.

LCA manufactures lithium copper cartridges in a variety of sizes to meet customer requirements.

Lithium Aids Fused Salt Electrowinning and Electrorefining of "Space Age" Metals

In the first half of the 20th Century, fused salt electrolysis had been developed as the chief industrial method for the production of some important metals, such as sodium, aluminum, calcium, and magnesium. The electrowinning of these metals has a number of advantages. Electricity is a low-cost means of reduction . . . high-purity products can be obtained . . . electrolytic methods are amenable to continuous production.

Most of the fused salt baths are based on compositions containing halides of the alkali metals, alkaline earth metals, and the specific metal to be deposited cathodically. The electrolytic production of such metals, as titanium, zirconium, thorium, uranium, molybdenum and beryllium is presently of great interest because of their applications in the field of atomic energy and in jet and rocket craft.

Lithium salts play an important part in the electrolytic production of some of these metals. In many instances lithium chloride is added to improve electrolyte conductance and fluidity and to obtain a low melting salt mixture. For example, the eutectic mixture of lithium chloride and potassium chloride (m.p. 350°C) is often used.

Lithium Corporation of America supplies lithium chloride in anhydrous form for this application.

Recently important work has been done on the electrorefining of beryllium to produce a high-purity product suitable for space and nuclear uses. The anode feed is crude beryllium metal and the bath consists of pure lithium chloride and potassium chloride of eutectic composition. The product deposits in the form of thin, platelike beryllium crystals of a purity comparing favorably with that of high-purity beryllium produced by other methods.

The use of lithium salts is not restricted to these "Space Age" metals, but has also contributed to a recent improvement in the field of aluminum production, where lithium carbonate or fluoride is added to the cryolite-based molten salt electrolyte. These lithium compounds are available from Lithium Corporation of America. Inquiries should be addressed to the Company's New York Office.

LITHIUM IN BRIEF

New developments involving lithium are constantly appearing in the literature. Each month some will be mentioned here briefly.

In an investigation of the electrorefining of beryllium, baths studied included LiCl-KCl-$BeCl_2$ mixtures. (3758)

•

High-purity cerium metal may be produced by fused salt electrolysis using fluorides of lithium, barium, and cerium. (3780)

•

A recently published report describes a method for determining the solution rate of metals in molten lithium, and covers the effect of additives in stainless steel and impurities in lithium as they bear on corrosion rates. (3882)

•

A new type of miniature electrical cell employs an anode comprised of indium, bismuth, and lithium. (3795)

•

Use of the eutectic mixture of LiCl-KCl is advantageous in the electrowinning of titanium. (3954)

•

The preparation of germanium or silicon semiconductors containing lithium is described in a recent patent. (3928)

•

Adherent coatings may be applied to titanium by immersion in aqueous acid fluoride solution containing lithium and ammonium ions. (3768)

•

The corrosion of various materials (pure metals, alloys, carbides) by molten lithium at elevated temperatures (1000-1900°F) was investigated, in both static and dynamic systems. (3907)

•

For further information, write our Technical Service Department, Bessemer City, North Carolina.

LITHIUM CORPORATION OF AMERICA, INC.

500 FIFTH AVENUE • NEW YORK 36, N. Y.

NEW YORK 36, N.Y. • CLEVELAND 14, OHIO • CHICAGO 1, ILL. • LOS ANGELES 36, CALIF. • BESSEMER CITY, N.C.

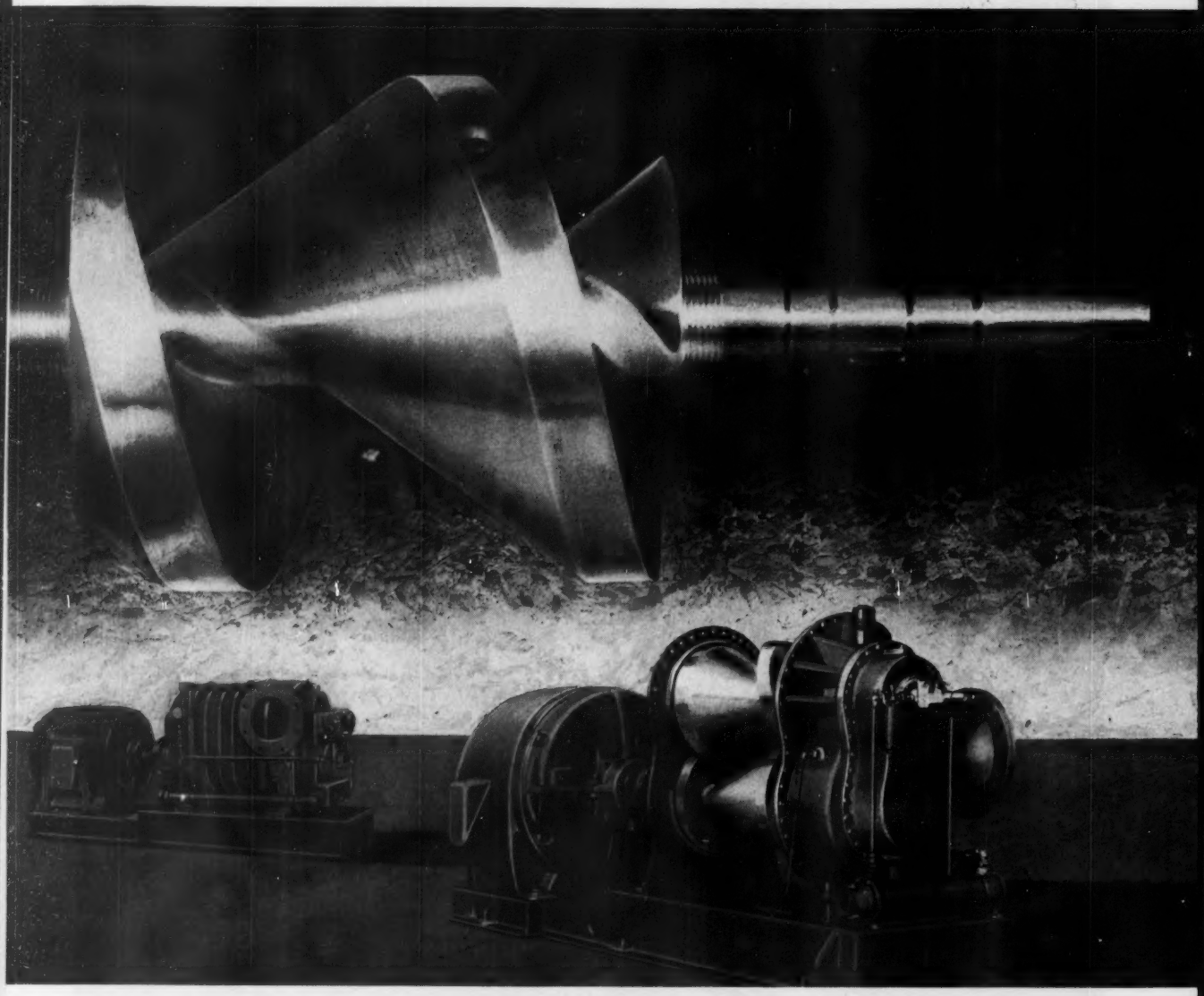
IMPROVE INSPECTION EFFICIENCY WITH ANSCO MONOPAK X-RAY FILMS

Modern non-destructive testing requirements call for fast and accurate flaw detection. That's why experienced technicians depend on Ansco Superay® 'A' and 'B' Monopak X-ray films . . . for quick and positive readings. Take advantage of the dependability and ease-of-handling convenience offered by Monopak. For information about how Monopak can improve your inspection efficiency write: Ansco Industrial X-ray Department, Ansco Division, Vestal Parkway East, Binghamton, New York.

Ansco
Monopak

Circle 602 on Page 39

How the Foundry Industry Serves America . . . #10 of a Series



CAST IRON ROTORS IMPROVE COMPRESSOR DISPLACEMENT 41%, REDUCE COST 29%

The original design of this air compressor called for forged steel shafts with pressed-on rotors, requiring a rotor hub large enough to key it to the shaft. This unit was subsequently re-designed to provide for integral-cast rotors and shafts which permitted smaller hub diameters and correspondingly larger rotors in the same cylinder. Displacement was improved by 41%. Lower cost of materials, less machining and shortened assembly time resulted in a 29% cost saving, as well.

Here is just one more impressive example of how the intelligent use of versatile iron castings by industrial designers can increase product efficiency and at the same time substantially reduce fabrication costs.

For the production of structurally sound iron castings, Hanna Furnace provides foundries with all regular grades of pig iron . . . foundry, malleable, Bessemer, intermediate low phosphorus, as well as HANNA-TITE® and Hanna Silvery.

Facts from files of Gray Iron Founders' Society, Inc.

HANNA
THE BEST-KNOWN NAME IN IRON

THE HANNA FURNACE CORPORATION
Buffalo • Detroit • New York • Philadelphia

Hanna Furnace is a division of **NATIONAL STEEL CORPORATION**

Circle 603 on Page 39

READERS' COMMENT

Foundry Technician Important

To THE EDITORS:

In the article "Foundry Technology—Where Is It Headed?" published in FOUNDRY, January, 1961, the thoughts on current foundry technology and education are well expressed.

I consider, however, that there is one developing trend that was not covered adequately. It is the developing in our educational system of the engineering technician who performs semi-professional functions of an engineering or scientific nature.

He is the necessary liaison man between the specialized engineer and the production employees in the foundry industry. He has received the practical-how-training in the foundry shop course that has generally been removed from the engineering curricula at the college level.

The changing of science and technology education in America should not reflect itself in apathy in the progress in the foundry industry.

Apparently this is a reason that foundrymen in some areas are reluctant to accept men technically trained in the basic fundamentals of casting of metals with the thought that they ultimately will become the supervisory personnel. Because this foundry technician, as he is termed, is nonproductive in that he is not actually producing molds, a misconception of his value is placed, and conservatism rather than liberalism becomes the axiom of that group in the foundry industry.

The technological skills must be continued to be developed for the practical side at the technical institute level. Specialization in foundry by the engineering technician will help fill the broadening gap existing in metallurgical gating and heat transfer by providing the second man on the foundry engineering team who has the so-called "feel" for practical application of basic information.

Therefore, I think the tide of education at the college level should not be expressed without that of the following tide, namely, at the engineering technical institute level.

J. GERIN SYLVIA
Senior Instructor, Foundry Dept.
Wentworth Institute
550 Huntington Ave.
Boston, Mass.

An Answer to Price Cutting

To THE EDITORS:

William Love, in his letter in the February issue of FOUNDRY, ably highlights a situation which has always been with the foundry industry and which exists in many other industries as well. It is the sad story of the man who unknowingly—in some cases knowingly—gives away ingenuity and skill, undermines his company's financial structure, and endangers the livelihood of himself and his employees by selling below cost.

When a foundryman doesn't know his costs, he undercharges some customers and overcharges others. Customers should deal with foundries which know their costs if they wish to be assured a continuing, reliable source of quality castings at a fair price. Foundries with facilities and supervision uniquely fitted for a particular job, and with full and accurate knowledege of their costs, can legitimately underbid others and make a profit.

The answer to the problem is found in the editorial in the September, 1960, issue of FOUNDRY which tells how trade associations help member firms, the entire industry, and the industry's customers. Cost accounting publications and recommendations, ratio analyses, and papers presented at meetings offer trade association members reliable guides to financial management.

At least two foundry trade associations—Gray Iron Founders' Society and Non-Ferrous Founders' Society—provide a cost comparison service which enables members who participate to pinpoint inefficient operations. This is accomplished through coded cost figures set up for comparison on a confidential basis so that only the organization's cost consultant and the participating

In the interest of the American foundry industry, this ad (see opposite page) will also appear in

STEEL
IRON AGE
MODERN CASTINGS
AMERICAN METAL MARKET

How the Foundry Industry Serves America . . . #10 of a Series
CAST IRON OUTDOES DIFFUSER COMPRESSOR DISPLACEMENT 41%, REDUCE COST 29%
YOUR NAME HERE

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REPRINTS OF THIS AD WITH YOUR FIRM'S SIGNATURE

If you would like to have reprints of this ad to mail to your customers and prospects, let us know. Reprints will have no Hanna product message or signature, but will be imprinted with your firm name and address. Absolutely no obligation. To order your reprints, fill in and mail the coupon below.

The Hanna Furnace Corporation
Detroit 29, Michigan

Please send me_____ reprints of Ad No.
(No.)
____ of your Foundry Industry Series.
Imprint as follows:

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Send reprints to:

NAME_____

I understand there is no charge for this service.

Circle 603 on Page 39

* CUTTING COSTS BY CUTTING SCRAP

Top dog in our cost-conscious Engineering group, Herman has this to say about the use of two 750 lb. Jolt Rollovers in an Erie foundry:

These particular molding machines have the outstanding operating characteristics of flexibility, speed, and simplicity.

They are producing, with an absolute minimum of scrap, 350 complete molds on a 7½ hour operating shift.

A variety of miscellaneous castings weighing from 1 lb. to 400 lbs. are produced on the unit, and patterns are changed as many as 10 times per day.

Flasks are 24″ wide and 30″ long. Cope mold is 10″ deep, and drag is 5″ deep.

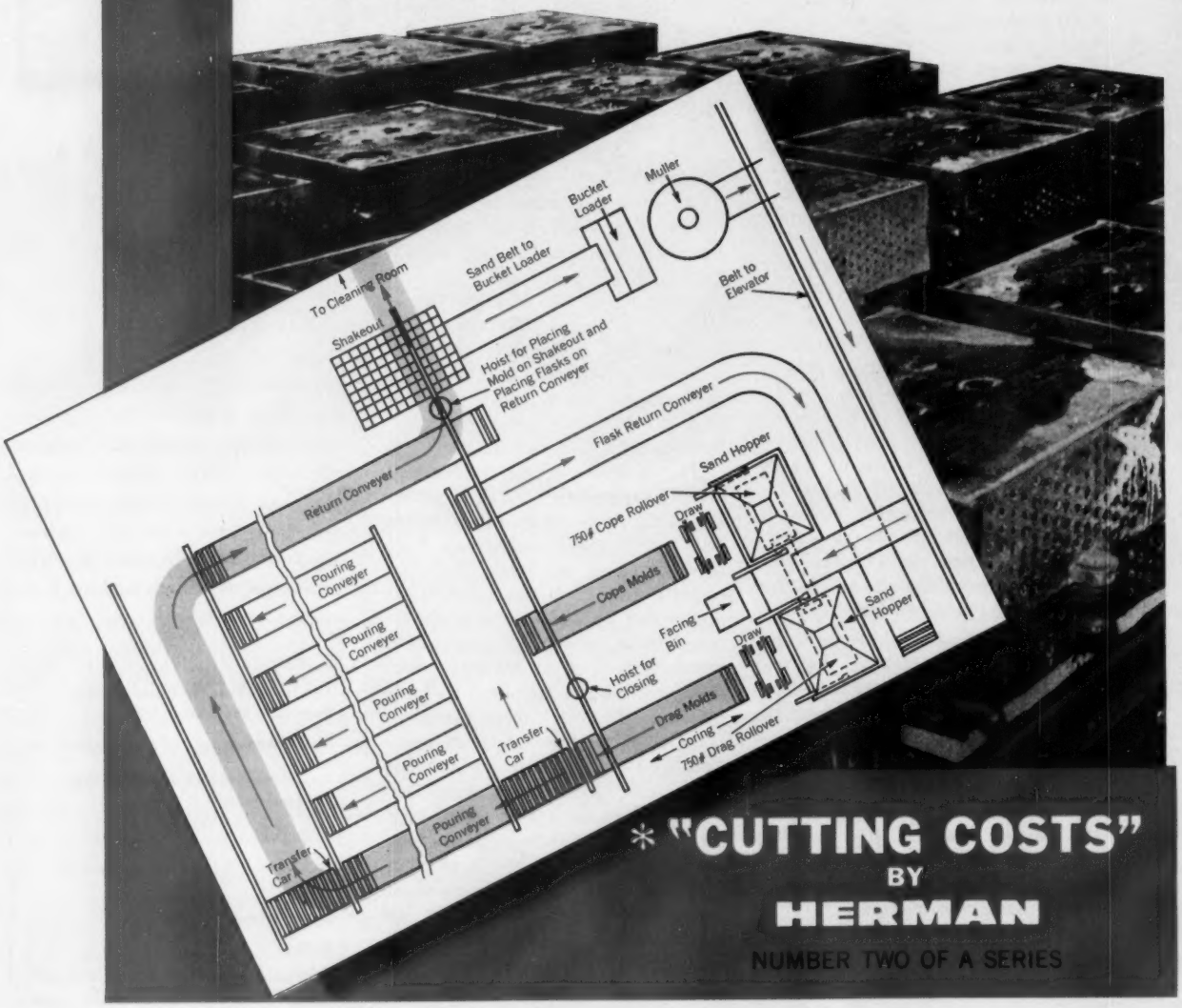
One rotary type valve controls all operations, for each machine.

The original capital investment in these molding machines was written off long ago.

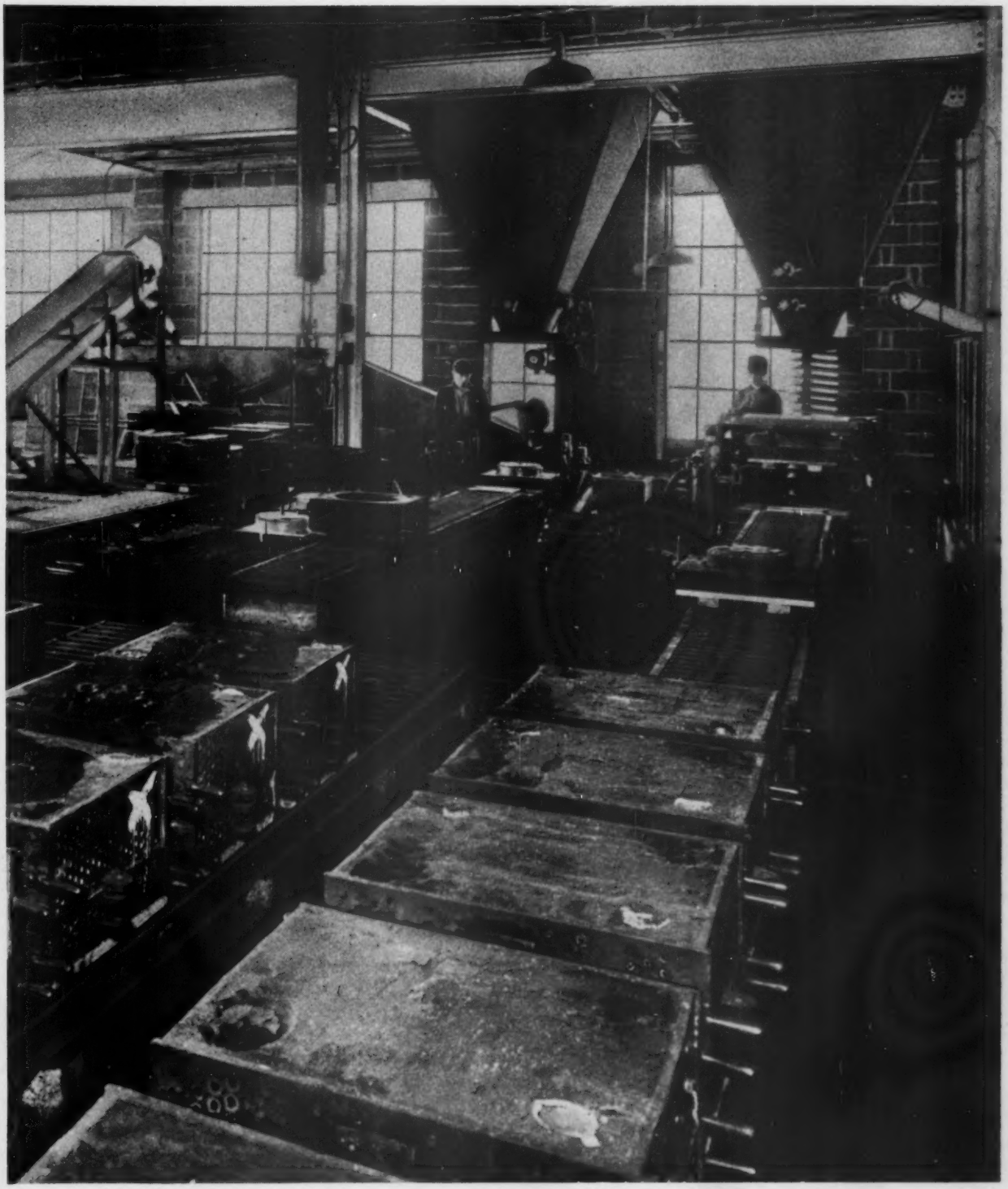
It would *pay* you to check with Herman about the cost-cutting possibilities of these machines in your plant.

There's a Herman Sales Engineer near you, and our catalog is available on request.

Why *wait* to bring yourself up to date?



* "CUTTING COSTS"
BY
HERMAN
NUMBER TWO OF A SERIES



HERMAN PNEUMATIC MACHINE CO.
UNION BANK BUILDING, PITTSBURGH 22, PA.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

Best Known and Most Progressive Name in Engineered Molding Machines.

Circle 604 on Page 39

clear the air for production

Dust produced by grinding, chipping and similar operations is removed as created by down draft dust control systems, pioneered by Kirk & Blum.

Whatever your problem in industrial dust control, call on Kirk & Blum, an organization of engineers and mechanics with 50 years' experience in this specialized field.

Write for complete information.
The Kirk & Blum Manufacturing Co.,
3108 Forrer Street, Cincinnati 9, Ohio

KIRK & BLUM DOWN DRAFT DUST CONTROL

firm can identify the firm's figures.

During the last year the Non-Ferrous Founders' Society completed its first Business Analysis and Profit Evaluation Report, which shows what member foundries did in the way of profits as related to sales and to net worth, what their capital, castings, and metals inventory turnovers were, and WHY. Our next BA & PE Report survey will be conducted in April of this year.

Trade associations are also extremely active in the field of marketing—finding what the customer wants and giving it to him at a profit. They're sharpening the sales tools of their member firm personnel and providing new tools with which to meet the ever growing competition from within and without the industry.

The NFFS Special Report No. 58, "What Our Customers Think of Non-Ferrous Foundries and the Castings We Produce," confirms the customer complaints portion of your February issue article, "How Designers Look at Future Use of Castings." SR 58, issued to members in September, 1957, in the early stages of our marketing program, shows that two-thirds of the casting consumers surveyed feel foundries should improve their quality control and inspection standards and one-fourth want something done about prices. Quality is uppermost in the customer's mind. In answering the question, "What influences you in placing an order?," 93 per cent of the firms said quality, service rated second in importance, and price came in a very poor third. This checks completely with a survey by Gray Iron Founders' Society.

Costs and marketing are only two of the important services available through foundry trade associations.

This office gets a number of requests each year for figures on foundry failures. Failures among NFFS members are so infrequent we do not bother to compile statistics. Failures outside the Society we don't know about, because such data are not readily available and we're too busy with foundrymen who are interested in sound costing, good financial management, and sensible selling practices.

HERBERT F. SCOBIE
Executive Secretary
Non-Ferrous Founders' Society Inc.
Evanston, Ill.

Hot stuff served up on rubber

Improved B.F.Goodrich belt saves customer $5500 in 13 months

THE cargo on that belt was causing plenty of trouble in this zinc plant. It's a highly abrasive sinter mix—still so hot at this point that it used to burn out belts after only 4 months' service.

When a B.F.Goodrich distributor heard about the trouble, he recommended a new kind of conveyor belt, called Solarflex, designed specifically for handling hot materials. This B.F.Goodrich belt is made of special rubber that stays soft and pliable at hot temperatures that cause other belts to harden, crack and finally break down.

At last report, the B.F.Goodrich Solarflex belt had been on the job 13 months. Belt service had tripled. And the customer had saved over $5500 in belt replacements and installation costs.

When you call on a B.F.Goodrich distributor for help with a conveying problem, you can count on getting the kind of belting that will keep things in your plant moving, cut down on repairs, and give you more for your money in terms of long, useful service.

BFG distributors have full information on this hot-material belt. And, as factory-trained specialists in rubber products, they can answer questions about the many products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Department M-977, Akron 18, Ohio.*

B.F.Goodrich

CONVEYOR BELTS

Circle 606 on Page 39

The Deming Company Reports on Shalco Shell Core Molding:

"A Vein-resistant Core Every Two Minutes... for 52% Less!"

There is good reason why The Deming Company, Salem, Ohio, considers two Shalco U-180 Shell Core Molding Machines an extremely sound investment; Assistant Plant Superintendent Jack Kerr puts it this way:

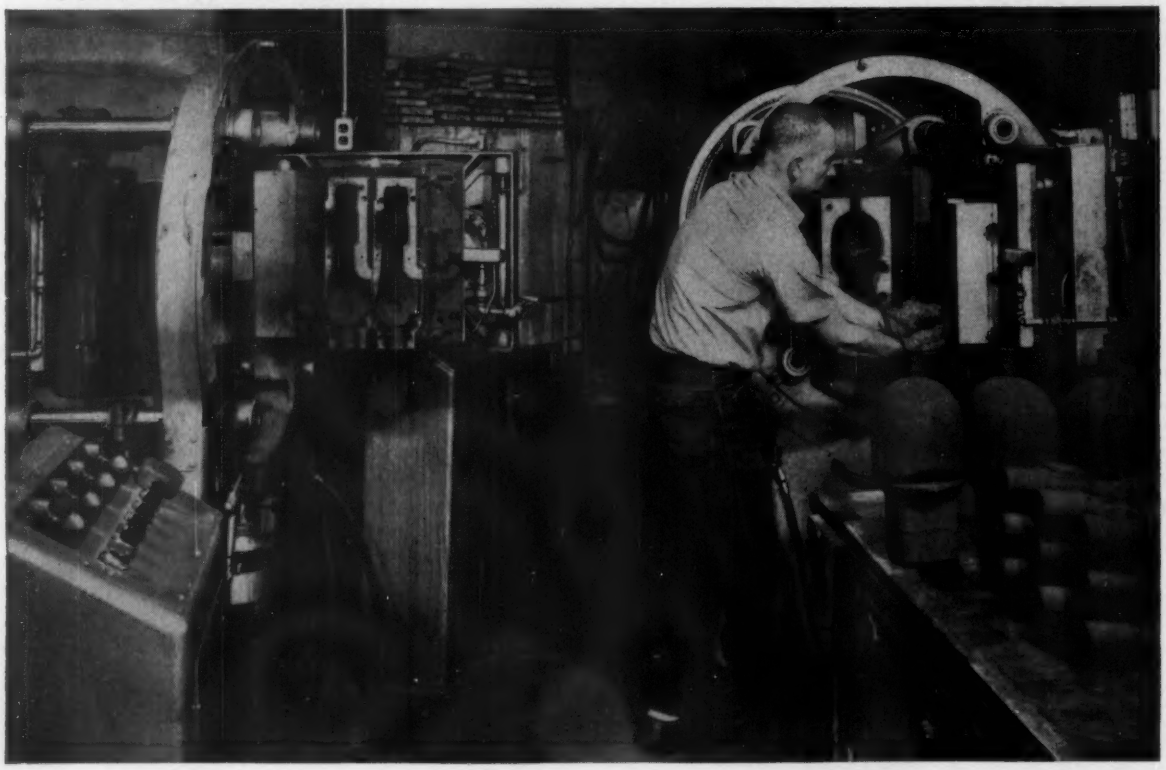
"In the last two years, we converted over 65 jobs to our Shalco machines and, as a result, saved money and increased product quality. For example, take one of our centrifugal casing cores that we used to make in halves with bench core makers. On the Shalcos, we eliminate pasting and sealing operations plus a two hour drying cycle . . . get a vein-resistant core every two minutes for 52% less. On the average job transferred to the Shalcos, we increase production 41% and require but ⅓ as much handling time. What's more, Shalco cores have far greater storage life than oil and sand cores and less moisture-drawing tendencies. There is also an average 10% savings in material."

Consider carefully what savings like those realized by The Deming Company could do for your profit picture. Then, call, write or wire for complete information.

Shalco Division of
National Acme
THE NATIONAL ACME COMPANY
173 E. 131st STREET
CLEVELAND 8, OHIO

Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

At The Deming Company, well-known manufacturer of "Pumps for all uses", one man operates two Shalco U-180's; produces top quality shell cores like those on the table.



WHEREVER METALS ARE CAST, FOUNDRY
MARCH 1961

What Is Needed

One of the major problems in planning for the future is to avoid being influenced unduly by immediate business conditions. Since 1929 the swings from the peaks of optimism to the valleys of pessimism have been drastic. Those who profited most during that period planned for the long term without being deterred by what was happening to business at any particular moment.

Many companies, mired in the depths of the 1930 depression, would have acted differently could they have judged the future in the light of what actually happened in the ensuing three decades. And many companies today will make the mistake of allowing current conditions to guide their planning for tomorrow.

Every industry must realize that change is normal and is particularly prevalent in the markets for materials. Steady growth in the number of different types of available materials has intensified competition in these markets; consequently, greater effort is required for a producer of any one material to maintain or increase his former share of the total business.

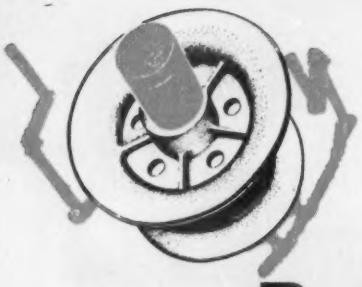
Although the first act of the so-called "Soaring Sixties" failed to live up to its advance billing, there is good reason for making future plans based on these two assumptions:

1. That we shall experience a continuation of the growth in the economy and population which has marked this country in the past. 2. That foundries will continue to supply a large share of engineered products, simply because casting is the best way to make those parts. How big that share will be depends partly on how vigorously foundries attack those problems which tend to restrict their markets.

You may not agree with all of Howard Taylor's criticism (Page 99) of the foundry industry for its slowness to encourage progress. But his conclusion that "foundries should be progressive, impressive, and expressive" pretty much covers what is needed if past mistakes are to be corrected in the future.

William G. Sutle

Editor



RISERING

Magnesium Sand Castings

Risers on magnesium castings will eliminate shrinkage, but they also serve other important functions. This article, No. 18 in our gating and risering series, spells out the necessary details

By ROBERT C. BOEHM
Director of Quality Control
Wellman Bronze & Aluminum Co.
Cleveland

● SIX MAJOR functions of risers for magnesium alloy sand castings are to eliminate shrinkage, provide vents, avoid the hydraulic ram effect, indicate when the mold is full, and to eliminate blows and misruns. The most important function is to eliminate shrinkage, but the value of the others should not be minimized.

Eliminating Shrinkage — The molten alloy contracts and the molding sand expands after liquid metal has entered the casting cavity. When the alloy solidifies, a further contraction takes place. Unless external feed material is supplied, numerous defects such as sinks or draws, shrinkage cavities, worm holes, microporosity, hot tears, or cracks may occur. To compensate for liquid contraction, mold cavity enlargement, and solidification contraction, the riser must be an effective source of feed material and the last portion to solidify.

Thus the first hard and fast rule to apply to the solidification of metals is that the riser must supply liquid feed metal to the casting as long as solidification shrinkage is taking place. The second rule to apply is that no section can be fed completely through a smaller section.

Although there may appear to be exceptions to this rule, close examination of the questionable application usually will show that the effective section size and cooling rate of the larger area was reduced to the level of the smaller section or below it by the use of chills, composite mold materials, or some special technique.

In Fig. 15, the side walls of the castings are too thick to be fed by the top riser because the size of the bottom of the riser is restricted by the groove on the top surface of the casting. Cast iron chills placed to cool the side walls of the casting improved the general quality of the part, but a high percentage of the castings still had excessive shrinkage. Filling in the groove at the top of the casting meant that a larger riser could be employed to feed the side walls, as shown in Fig. 16.

No additional cost to either the foundry or the machine shop was involved following the engineering change worked out through the cooperative efforts of the design and foundry engineers. This example illustrates the fact that feeding a large section through a small area is difficult—and in some cases impractical.

The third basic principle of risering is that freezing of the metal must begin at the point farthest from the riser. This goal can be accomplished by the use of chills to initiate solidification. Freezing then should continue progressively along the casting. Risers, regardless of their size, will feed only a limited distance. Therefore, various adjacent casting sections have to feed themselves progressively, leaving only the last portion of the casting to solidify to be fed by the riser.

The fourth basic principle to apply to the solidification of metals is the need for a force that will cause metal to flow. At various stages of the solidification cycle, gravity, atmospheric pressure, surface tension, and capillary action affect a riser's feeding ability. Gravity and atmospheric pressure are the major forces. Because of the effects of the various driving forces, top risers are more effective than bottom risers. Even the top riser will be most effective, however, if large thermal gradients can be established from the riser to the section being fed.

Riser Size—As stated earlier, a primary function of a riser is that it remain liquid until after the casting is completely solid. Chvorinov[20] and Caine[21, 22] proposed general formulas for the minimum size of effective risers, based on a relationship between the surface area and volume of the casting and the riser. The formulas in effect state that the riser should have a large ratio of volume to surface area compared to that of the area of the casting being fed. The rela-

tive solidification rate of the riser and the casting, since they are in contact with the same sand, could be considered dependent on the relation between the surface area and volumes of the casting and the riser.

The equations developed by Chvorinov[20] and Caine[21, 22] are based on the assumption that the total area of the casting and the riser is in contact with a sand wall of semi-infinite depth, capable of absorbing all the heat emitted by the casting and riser until they solidify. Furthermore, it is assumed that heat is extracted uniformly from the riser and casting surfaces.

When castings are produced, a sand wall of semi-infinite depth is not in contact with the entire surface area, and differences in the thickness of the sand wall produce variations in the rate of heat absorption. Attempts to calculate minimum riser size are complicated further by molten metal contact with small internal cores, chills against the casting, changes in section, the rapid cooling of external corners, and the slow cooling of internal corners.

In magnesium sand castings, many risers are filled with metal that has passed through the casting cavity, as shown in Fig. 17. The metal coming to rest in the riser is cooled as it passes over the sand in the casting cavity and, as a result, is colder than the metal coming to rest in the casting cavity. Thus, the metal needed in the riser must be of sufficient volume to reverse the initial adverse thermal gradients and to promote progressive solidification.

In Fig. 18, the riser is the same size as that in Fig. 17, but in this instance the riser is filled with metal coming directly from the ingates. Hotter metal is entering the riser with this gating technique, and a smaller riser can be employed. A third condition is shown in Fig. 19, wherein the riser is hot topped. A smaller riser could be employed than the one filled by passing metal through the casting, as in Fig. 17, but the riser would have to be somewhat larger than the one filled directly from the single ingate, as in Fig. 18.

These examples illustrate that, even though riser and casting size are identical, completely different solidification patterns can be obtained with identical riser and casting section sizes, depending on the flow pattern in the mold. Simply making the riser volume greater than the adjacent casting section offers no assurance that the riser will be the last section to freeze. The flow patterns in the mold must be considered in evaluating feeding patterns based on the relative riser and casting sections involved.

Application of chills sometimes makes possible the use of a riser bob to feed a casting section that is larger than the riser bob itself, as shown in Fig. 20. A normal riser could not be utilized, because of a tight flask condition illustrated in the upper view of Fig. 20. A sink or draw was obtained when chills alone were added. Further addition of the small riser bob, in conjunction with the chills, produced a sound casting.

The riser should be more massive than the casting to be fed, as indicated previously, it is obvious that the minimum size of effective riser can not be predicted on the basis

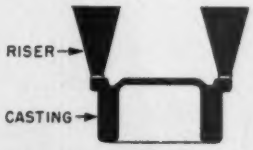
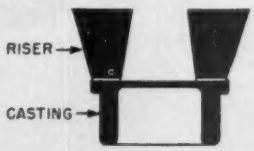


Fig. 15—Top risers are too small to feed casting adequately. Fig. 16—Filling in groove on the casting permits the use of risers large enough to feed side walls



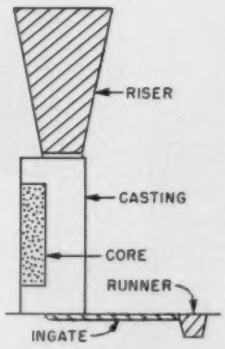


Fig. 17—Metal in this riser cools while flowing through the mold

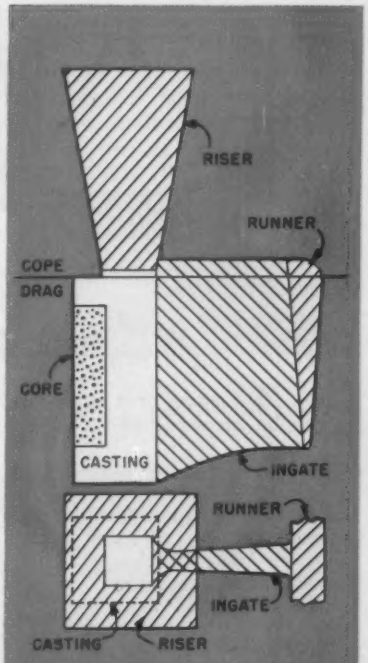


Fig. 18—This riser is filled with metal directly from the ingate. System provides riser with hot metal for feeding

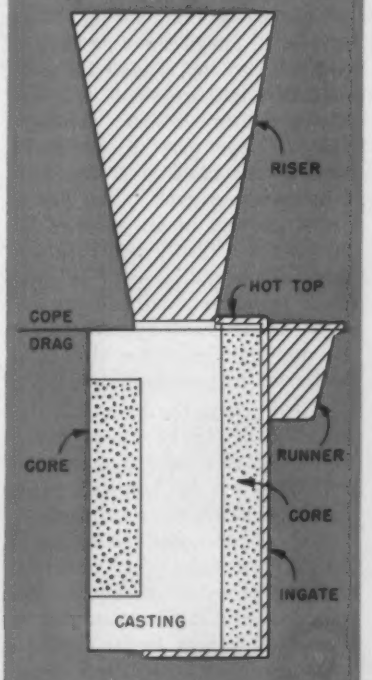


Fig. 19—Hot top channel feeds hot metal into riser after the mold cavity has filled through the ingate at the bottom

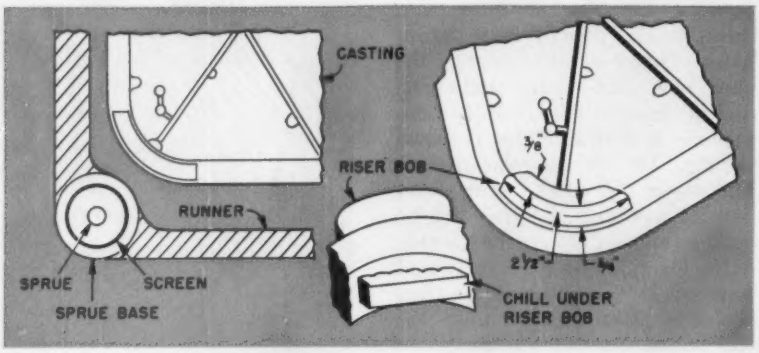


Fig. 20—Feeding of a casting section where an ordinary riser won't fit can be accomplished by using a chill in conjunction with a riser bob

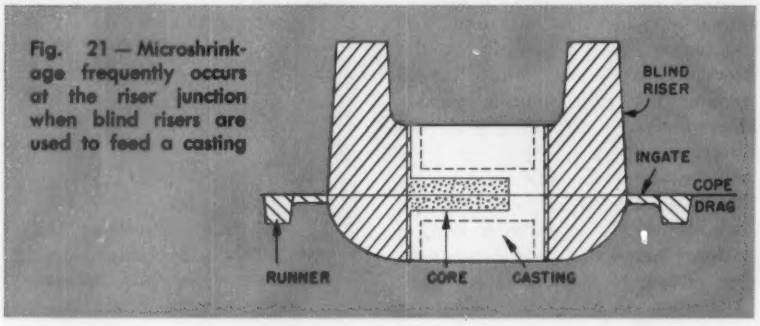


Fig. 21 — Microshrinkage frequently occurs at the riser junction when blind risers are used to feed a casting

of the relative masses of the riser and casting sections alone. Since the sale of magnesium castings is principally to the aircraft industry, production lots are small and lead time on delivery is short. Furthermore, a large part of the excess metal in the mold is in the form of runners and gates. The loss of 3 or 4 castings in an order of 50-100 does not justify the time and effort that would have to be spent or the relatively small savings that might be obtained by establishing the minimum effective riser sizes that could be employed.

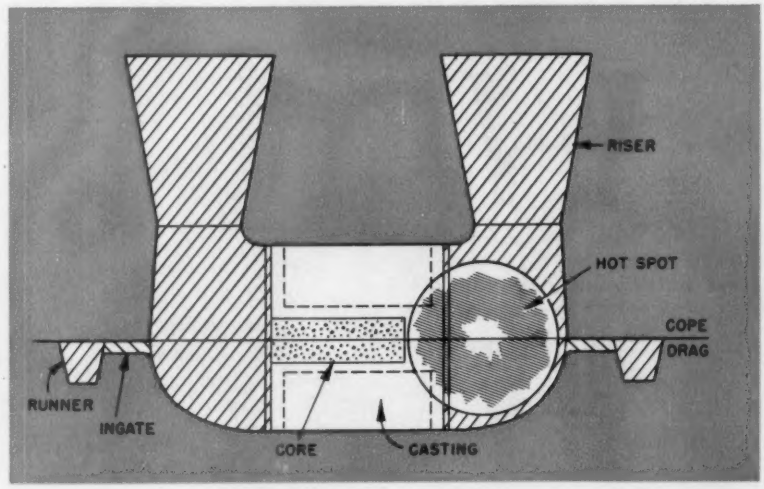
In addition to the basic rule that the riser should be more massive than the casting section, some general rules can be followed in establishing workable riser sizes. It is advisable to make the section of the riser on top of the casting as wide as the section to be fed. Progressive solidification from the top section of the riser to the casting is desired, and all loose risers should be tapered to aid in eliminating shrinkage as well as to ease molding. A 10-degree taper can be expected to provide good directional solidification in the riser and to minimize the possibility of shrinkage at the casting-riser interface.

Riser Connections—The method of attaching the riser to the casting is a very important factor in the risering of magnesium alloy castings. A poorly designed riser junction often is the region of localized, concentrated porosity. In Fig. 21, the casting is fed by blind risers. With a riser that is permanently fixed to the pattern, high production rates can be achieved without visible surface shrinkage. X-ray examination, however, can be expected to disclose microshrinkage in a part risered in the manner illustrated.

A casting of intermediate quality would be obtained by utilizing a combination blind riser and loose riser as shown in Fig. 22. This technique provides an improved solidification pattern, but a hot spot still exists in the area encircled in the drawing. A further improvement in quality can be achieved by employing a vertical riser pad and a full loose riser as illustrated in Fig. 23. In almost all instances, this risering technique will produce a sound section.

Riser Pads — The casting and riser normally are separated by riser pads. These serve as a guide for the cleaning department in trimming the casting. When used for this purpose, 1/16 to ⅛-in.-thick riser pads are employed. When generous fillets between the riser and casting are desired, however, riser pads as thick as ½ inch can be utilized. Riser pads are essential when vertical slot gates are used in conjunction with piston risers. Without the riser pads, a line of visible surface shrinkage usually is evident in the small fillet along the length of the riser.

Fig. 22—A combination of blind and loose risers is utilized with this casting. This technique provides a solidification pattern that is better than that of the casting in Fig. 21, but a hot spot still exists



When the mold is jolted, top riser patterns will ram into the casting pattern and, on wood equipment, considerable localized wear will result. Wear or damage to the pattern attributable to this condition can be eliminated by the use of riser pads, cost of which on wood equipment is negligible.

Bottom Feeding — The importance of metal temperature on quality and the steps taken to design a gating system to assure that the molten metal flowing into the mold cavity would be at a fairly uniform temperature were discussed in detail earlier. The low heat content of liquid magnesium and the adverse effect of heated sand on casting quality present just as serious a problem in the risering of a casting.

As an example, the top riser in Fig. 24 would not feed the side walls adequately. The addition of two small, fixed blind risers connected to the flange at the ingate reduced the extent of the porosity seen in the radiographs. Increasing the size of the fixed risers continued to reduce the porosity until a stage was reached where a reversal in the trend was obtained and further increases in size of the risers produced increased quantities of porosity.

Experience obtained from problems with other castings of a similar nature suggested that the porous condition could be attributed to excessive heating of the sand between the risers and the casting. To confirm this concept, loose risers were tried. They provided more feed material, but also heated the sand between the risers and casting to a greater degree. As was expected, more porosity was disclosed in the side walls by the radiographs than was evident in the films of any other test casting. Moving the fixed risers back from the casting eliminated the porosity.

A favorable taper from the standpoint of heating the sand between the risers and casting is obtained with blind risers. Because of this, a part of better quality was produced in this instance with the blind fixed risers than could be procured with loose risers.

Also, temperature of the sand was held down in the critical area during solidification of the part by placing the ingates under the casting. This step produced a much higher quality part than was secured by gating directly into the flange. Tapering the ingates so that the thick sections were under the riser and the thin sections were under the casting produced the best feeding conditions. Thus, a risering problem was solved and a sound casting was procured by employing the bottom feed risering technique shown in Fig. 24.

Riser Factor of Safety — Slight variations in the flow pattern can cause more molten metal to run over a particular mold area on one occasion than on another. Thus, conditions within the mold can be altered to the extent that the gating system will not function in the same manner for each casting. This could explain why castings poured under seemingly constant conditions vary in the degree of shrinkage disclosed by radiographs.

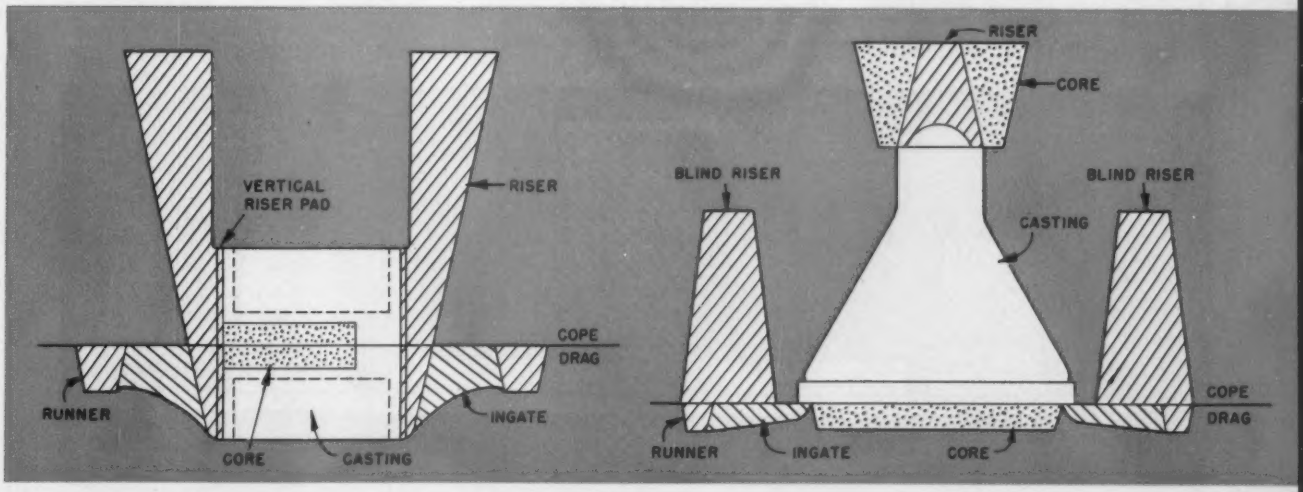
If excessive shrinkage appears consistently, steps readily can be taken to revise the gating system, and the risers or the casting design can be altered to overcome the problem. Instances can be cited when sound castings are obtained one day and excessive shrinkage is encountered the following day. The most probable explanation for this fluctuation is that the part is undergated or underrisered to the extent that an insufficient safety factor exists to compensate for variations encountered in day-to-day production.

In some instances, that the writer would like to quote, design of the casting is such that satisfactory gating is extremely difficult. The factor of safety is too small, and more than normal scrap often can be expected.

Riser Spacing—In general, heavy sections of a casting are risered, and adjoining light sections, such as webs, ribs, and connecting walls are fed by the heavy sections. Spacing of the heavy sections of a casting is determined by the design. In

Fig. 23—Use of these loose risers will result in a sound casting. Compare this riser arrangement with those shown in Fig. 21 and 22

Fig. 24—Two small, fixed blind risers were added to the casting when radiographic inspection showed that the top riser did not feed the side walls



a casting of intricate design, a separate riser for each boss or heavy section cannot be employed. In such instances, a decision as to whether to attempt to feed the massive section through surrounding, thinner-walled sections by the use of chills must be made.

Chills—Chills sometimes can be used in place of risers to minimize or eliminate shrinkage by increasing the solidification rate locally. With chills, a heavy section can be fed through a thinner section if the thickness of the heavier section is less than about 2½ times that of the thinner section. Where heavy bosses are spaced too close together to permit the use of individual risers, chills can be employed to supplement the risers utilized to produce a sound casting, which otherwise would be of inferior quality.

Other Reasons for Risers — In some instances a blind (inverted and permanently fixed to the pattern) riser would feed the casting adequately. The section could, however, be in a blind pocket in the mold. Rapid flow of molten magnesium into the blind cavity might be hazardous if the molding sand was high in moisture and low in permeability. A normal open riser will provide ample venting to avoid entrapment of the mold gases and eliminate the danger of an explosion.

The stream of metal entering the casting cavity can have considerable kinetic energy. If little space exists for the metal to enter when the mold cavity is filled, the metal stream halts abruptly. The liquid metal exerts excessive pressure against the mold walls, causing penetration of the metal between the sand grains, and a rough casting results. In an extreme case, the cope and drag halves might even be separated. The kinetic energy is dissipated gradually by open risers as they fill; thus the problem of the hydraulic ram effect is eliminated.

When numerous small castings are mounted on a squeezer plate, the runner can be enlarged to serve also as a satisfactory riser. Without an additional open riser, this practice can introduce pouring problems since the pouring crew needs some means of determining when to stop pouring. This point can be estimated by watching the flow of the liquid metal in the mold through the open riser.

Numerous magnesium sand castings are being poured with cast-in inserts. As is evident in Fig. 25, the insert will chill the metal and a casting without shrinkage in the area would be obtained without a riser. An excessive number of castings, however, could contain blows caused by the relatively cold insert. If a riser is placed over the insert and surrounding casting wall, the steam and gas generated are washed into the riser, leaving the molten metal in intimate contact with the steel insert.

In long, thin plates or in thin sections at the ends or sides of a casting, the areas in the corners of the mold, especially those opposite the sprue, are prone to misruns. If a riser is placed at the end of the part the cold metal will flow through the casting and into the end riser. The succeeding hot metal will fill the casting cavity completely. The riser may not be needed to feed the part, but is used in this application to eliminate the misrun or coldshut condition.

Acknowledgments — The author expresses his sincere appreciation to the Wellman Bronze & Aluminum Co. for permission to publish this article. He also is indebted to Eugene Rearick and John Schmid for the encouragement and helpful suggestions given. In addition, the aid of Raymond Malicki, who drew the illustrations, is acknowledged gratefully.

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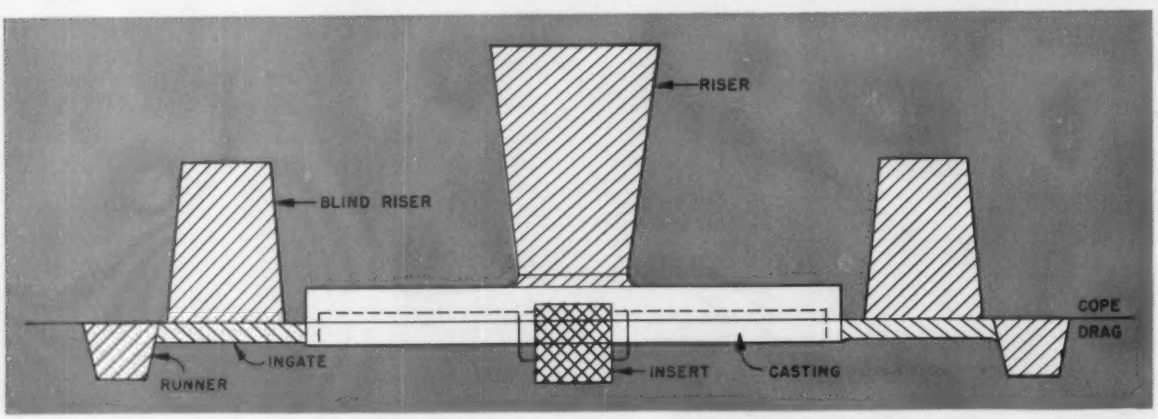
Fig. 25—Blows caused by an insert can be avoided by using a riser as shown. Setup allows generated gases to be washed into the riser metal



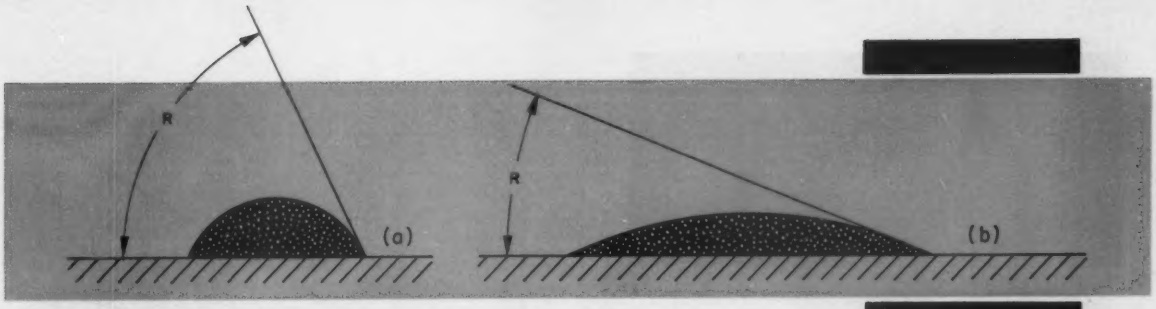


Fig. 1a—Drop of ordinary water on a flat surface exhibits large contact angle. Fig. 1b—Adding surfactant results in spreading, smaller angle

Use of Wetting Agents in the Foundry

Molding sands with higher green strengths can be produced if water treated with wetting agents is employed. This application and others are discussed here

By WILLIAM N. RICHARDS
Chief Engineer
Deynor Corp., Mamaroneck, N. Y.

Fig. 2a—Contact wetting of ordinary water is limited, as can be seen here. Fig. 2b—Treated water spreads more easily

● WETTING AGENTS are a helpful addition to the foundryman's bag of tricks for certain applications. Technically, these materials are known as surface active agents or surfactants. Their use is common today since all household detergents are merely forms of wetting agents. The following basic information on wetting agents and practical examples of their use should help foundrymen assess the value of these products in foundry practice.

Surface tension in liquids makes the use of wetting agents desirable. This phenomenon causes drops of water to try to assume spherical shapes when they are placed on a flat surface. As with most liquids, these drops of water are trying to form into shapes with the least amount of surface area, and the sphere has less surface area than any other shape containing an equal volume. Forces of molecular attraction generate the surface tension.

Changes Contact Angle—Fig. 1a shows a drop of ordinary water; Fig. 1b shows a similar drop to which a surfactant has been added. Notice that the contact angle R in Fig. 1a is greater. When a drop of liquid is placed on a solid surface, the drop will spread so long as the adhesive force between the liquid and the solid is greater than the cohesive force between the molecules in the liquid. When these two forces become equal, the system is in equilibrium.

In a simple liquid binary system we have molecules A and B. These two types of molecules will have different fields of attractive force. Assume that molecule A has the greater attractive force. Due to this force, the A molecules will gather in the center of the liquid, forcing the B molecules to the surface. Most water-soluble organic materials behave as B molecules because they have a weak attractive force. When such materials are placed in water, they are forced to the surface, causing the surface tension to be decreased. Surfactants show this effect to an extreme degree.

Three Actions—The term "wetting" means the following three actions, which, when taken together, cover all geometric forms of wetting: 1. Contact wetting is the measure of the tendency of a liquid and a solid to adhere on contact. 2. Spreading wetting is the measure of the tendency of droplets to spread over and wet a relatively flat surface. 3. Penetration value is the measure of the tendency of a liquid to penetrate into small crevices and capillary spaces.

Fig. 2a shows a grain of material

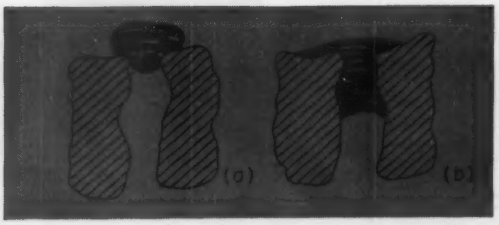


Fig. 3—Ordinary water (a) penetrates between particles less than treated water (b)

as it comes into contact with a normal water solution. Notice that the contact angle is greater than 90 degrees. In this case, the water does not want to wet the material. Fig. 2b shows the same situation with a suitable surfactant added to the water. The grain in this case will be wetted instantly by the solution. Notice how small the contact angle is between the grain and the advancing edge of the solution. This is the necessary situation for contact wetting to occur.

Spreading wetting is a continuation of contact wetting. Once the liquid and the solid have made contact, the liquid must have the ability to continue the spreading action. Fig. 1b shows the condition which must exist for spreading wetting to occur. The contact angle R must be small enough so that the spreading will be continued until the particle is completely covered.

Penetration value can best be described in terms of capillary action. In fact, the rise of a liquid in a capillary tube is used to measure the surface tension of a liquid.

Fig. 3 shows the practical effect of this penetration value. The wetting actually is accomplished through the tiny passages formed by the individual grains of material. As in the capillary tube, the more acute the angle R is at the beginning, the farther into the material the liquid will travel, and in a shorter time.

Requirements of Agent—To be an effective wetting agent for industrial use, a surfactant must possess several characteristics. It must be a simple, stable compound that is effective in extremely dilute proportions, yet is inexpensive. If the solution contains minerals, acids, or alkalies, the compound must not be affected by them. It must be as nearly neutral as possible so as not to disturb the pH of the solution.

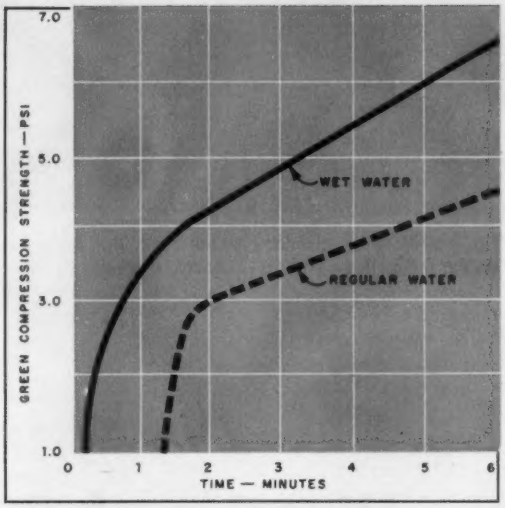


Fig. 4—Less mulling is needed to obtain high green strengths when wetting agents are used

It must be completely soluble in water, but it must concentrate at the solution's surface. Finally, a wetting agent must possess electrostatic characteristics which will allow it to wet materials regardless of which sign (positive, negative, or neutral) they have.

Water is added to most molding sands to enable the clay bonding agent to do its work. The bonding action of a useful clay comes from two properties—cohesion and adhesion. Cohesion is the sticking together of the clay; i.e., an attractive force between particles of the clay. Adhesion, on the other hand, causes the clay particles to stick to the sand grains. Both properties are required for a clay bonding agent to be useful, and water must be added before either will exhibit itself.

Southern and western bentonite rate high in both properties, but fire clays have only a moderate rating in both. Other clays have superior cohesive properties, especially when compared with fire clays, but are totally lacking in adhesive properties. Southern bentonite and the fire clays can be wetted successfully, though not easily. Western bentonite, however, is an excellent waterproofing material. Water added to the material forms clay balls which can be broken only by extensive mulling.

For best results, the clay-water mixture must be spread thinly over the surface of every grain of sand. Total surface area of a 1000-lb batch of AFS No. 63 sand is more than 8 acres. Under practical conditions, a muller is required to mix 50 lb of clay with about 7 gallons of water and spread the mixture over the 8 acres.

A Typical Example—A wetting agent was used in the following experiment to show its effectiveness. Sand used was new Dividing Creek "C" AFS No. 73. To this sand, 5 per cent western bentonite was added and the dry mixture was mulled for 2 minutes. Then, 2 per cent water was added and the mixture was mulled again. Samples were taken once a minute for 6 minutes of mulling time. Fig. 4 compares green compression strengths of the sand mixes with and without a wetting agent.

The batch with the wetting agent reached a strength of 4.2 psi after only 2 minutes of wet mulling. Without a wetting agent, this strength was not reached until after 6 minutes of wet mulling. Two conclusions can be drawn from the experiment. First, the wet mulling cycle for developing a given strength can be reduced considerably. Second, a higher green strength can be attained from a given quantity of clay with a normal mulling time.

Water also is added to give flow-

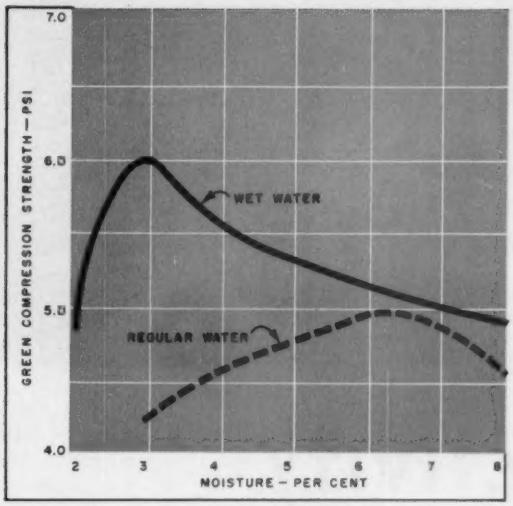


Fig. 5—Peak green strength is reached with a lower moisture content if water is treated

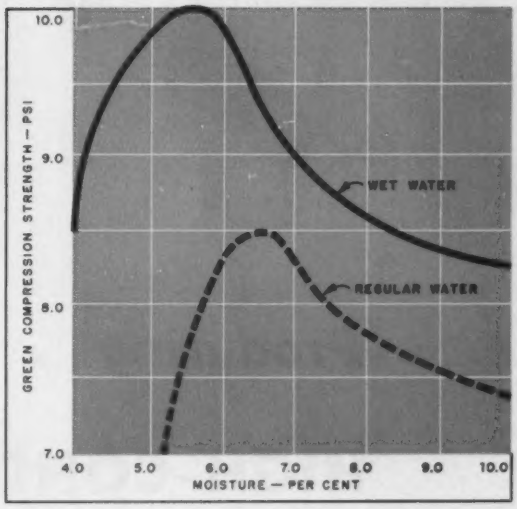


Fig. 6—For a particular sand mix, use of wet water gave this increase in green strength

ability or moldability to the sand. Increases in the moisture content of a molding sand will increase its flowability to a point well beyond the practical limits of foundry operations. A point is reached, however, beyond which green strength decreases with increases in moisture content. Fig. 5 shows this point graphically.

Most foundries operate with a moisture content to the right of the strength peak (Fig. 5). In other words, foundrymen are willing to sacrifice some green strength for workability. Again, wetting agents can play an effective role in the problem. Use of a wetting agent in a molding sand permits use of less water without losing flowability.

The reason for the foundryman's desire to use less water is obvious. Less water means quicker oven drying of dry sand molds and fewer defects caused by excessive moisture.

Effect on Strength—Although it is impossible to draw any typical strength curves it is possible to show one of the typical molding sand mixes. Fig. 6 shows data for a sand mix made up of the following constituents: 80 lb naturally bonded Albany sand AFS 135-150, 140 lb returned sand (same), 1½ lb southern bentonite, ½ lb western bentonite.

This is a mixture used in a brass foundry. The curve for sand with the wetting agent shows a 27 per cent decrease in moisture content with an accompanying increase of 17 per cent in green strength. The permeability was unchanged and the flowability was improved.

One might suspect that the use of a wetting agent and less water might be accompanied by drying out of the mold. Instead, the opposite is true. An improved electrical bond holds the water more securely to the clay substance and sand grains than do the physically bonded outer layers of water which exist when no wetting agent is used.

Aids Sand Washes—A wetting agent greatly improves the covering characteristics of mold and core washes. An easy test to make is to add a wetting agent to one batch of mold wash. Dip one pin core into this mold wash and another into an ordinary batch; then break each pin core. Check the depth of penetration of the mold wash in each case. Increased penetration occurs in the pin core dipped in the batch with the wetting agent.

The cracking of a cupola lining or ladle lining on drying is caused by the evaporation of excess moisture. As with molding sands, there is a tendency to use extra water to simplify the placing of the material. In addition, many materials used for cupola and ladle patching and for lining crucible furnaces are difficult to wet. This is especially true of certain materials used with patching guns. The addition of a wetting agent to the mixing water reduces the necessary water as much as 15 per cent. Also, when using a wetting agent with a patching gun a considerable decrease of drop material is evident. The fact that the bond is greatly increased, even with less water, means that the patching material with a wetting agent sticks to the walls much better than one without it.

Blends Are Best—Due to the definite electrostatic characteristics of single-phase wetting agents and various foundry materials, it usually is necessary to use a multiphase (balanced blend of different wetting agents) compound for best results. Such wetting compounds, in several forms, are on the market and in wide use.

Exact rules for the use of wetting agents cannot be set down, because each situation demands its own approach. It seems safe to say, however, that almost any situation involving the use of water represents a potential application for wetting agents. Much research now is being conducted on this subject and much more needs to be done in the future to take full advantage of the usefulness of these products.

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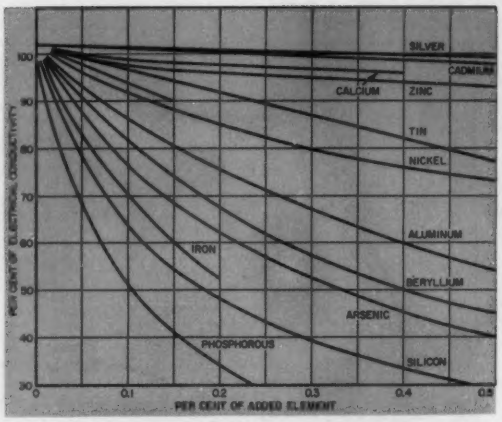
Fig. 1—Plot shows effect on conductivity of copper when other elements are added



Producing HIGH-CONDUCTIVITY COPPER CASTINGS

Special techniques have been developed to produce castings of high conductivity copper. The authors discuss these procedures, which are helping foundrymen to meet conductivity requirements

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● MAN'S individual progress, with recent emphasis on space-age electrical and electronic equipment, demands castings of greater thermal and electrical conductivity than any previously required. For these purposes, copper is second to none among the base metals.

To provide the highest possible conductivity, however, copper must be free from impurities, and the inherent softness and weakness of pure copper limit its application to electrical components not requiring high strength or hardness.

Acceptable alloys which solve this problem are not easy to make because, as shown by Miller,[1] even very small additions of alloying elements have a serious effect on the electrical conductivity of copper (Fig. 1).

High-Conductivity Alloys—In recent years, however, a group of alloys has been developed known as high-conductivity copper alloys. They were produced by adding to the copper very small quantities of those elements which least affect electrical conductivity, but still impart such desirable features as high strength, resistance to wear, and increased softening temperature.

These elements are silver, chromium, cadmium, and tellurium, all in amounts less than 1 per cent. Chromium copper is the most satisfactory for the production of castings. The others generally are supplied in shapes to be wrought or drawn.

In comparison with the large quantities of other copper-base alloy castings (bronze, brass, gunmetal) produced by the foundry industry today, the tonnage of high conductivity castings made is relatively small. Therefore, the average nonferrous foundry has little experience with such alloys, and their production is left to those few within the industry who have mastered the art. The production of high conductivity castings probably requires greater skill and scientific knowledge than that of most other copper-base alloy castings.

Gas Porosity Is Problem—The

TABLE I—Effect of Oxygen on Physical Properties of Copper

Oxygen Content, per cent	Density	Tensile Strength, psi	Elongation, % in 2"	Electrical Conductivity, As Cast
0.02	8.49	21,700	26	95.4
0.09	8.50	16,100	10	94.7
0.12	8.20	15,700	11	94.0

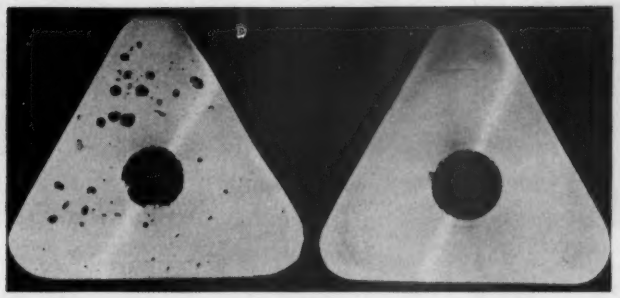

Fig. 2—Comparison of sectioned castings shows defect due to a phenomenon usually termed steam reaction

Fig. 3—A sound casting is obtained when riser shows cavity (left), but a puffed-out riser head indicates gas was present

major problem in casting high-conductivity copper alloys is unsoundness due to gas evolution, which forms small bubbles of gas as the metal solidifies. Origin of the gas can be attributed to two causes: 1. The release of hydrogen from solution in the liquid metal. 2. A combination of hydrogen and oxygen causing a phenomenon usually termed steam reaction. A typical example of this defect is shown in the casting on the left in Fig. 2.

If one of these reactions takes place in the mold, the evidence usually is apparent on the surface of the metal in the running system through which the casting was poured. If the casting solidifies soundly, without the ejection of gas, the surface of the riser sinks as the last liquid feed metal is drawn into the casting to counteract liquid shrinkage, and a typical pipe (Fig. 3, left) is produced.

If, on the other hand, gas is ejected from the casting, the resultant pressure prevents any more liquid metal from feeding into the casting and even attempts to eject additional metal by spewing, producing a honeycombed cauliflower head (Fig. 3, right).

The reason for these phenomena readily is explained. Molten copper can dissolve hydrogen to an alarming extent, but the solid metal can retain only much smaller amounts in solid solution. If the amount of gas taken into solution during melting exceeds the amount which can be retained after solidification, the excess is ejected as bubbles during the cooling process.

Unsoundness caused by hydrogen alone is not so prevalent as that resulting from steam reaction. Oxygen, existing in copper principally as cuprous oxide, is not liberated from the melt as hydrogen is; so oxygen alone does not lead to gas unsoundness. The presence of cuprous oxide in the solidified casting, however, seriously affects physical properties, although electrical conductivity is relatively unchanged (Table I).

Furthermore, oxygen as cuprous oxide and hydrogen in solution exist in equilibrium while the metal is molten, but cooling upsets the equilibrium conditions. The reversible reaction shown by the following equation proceeds rapidly in the righthand direction:

$$H_2 + Cu_2O \rightleftarrows 2\,Cu + H_2O$$

The water vapor which is formed is entirely insoluble in solid copper and is liberated at the crystal boundaries of the solidifying metal, especially in those places where the metal solidifies last. In serious instances, this reaction is evidenced by severe spewing at the mold surface.

These reactions also are possible in bronze, brass, and other copper-base alloys, although they occur to a much lesser extent. The solubility of hydrogen—expressed in cubic centimeters per 100 grams of metal—in various copper-tin alloys at the approximate practical pouring temperature of the individual alloys (about 100-150° F above the melting point) is shown in Table II (Bever and Floe).[2] It readily is apparent that an increase in tin decreases the amount of hydrogen which can be taken into solution.

Furthermore, alloys containing zinc—brass, for example—are free of gas porosity because zinc boils at 1665° F, and the high vapor pressure set up by the zinc during melting protects the metal from harmful gasses.

Control of Gas Content — For these reasons, the foundryman must pay strict attention to melting technique to avoid porosity from hydrogen alone as well as from the com-

TABLE II—Solubility of Hydrogen in Copper-Tin Alloys at 100° Above Liquidus

Copper Content	Tin Content	Cu Cm Hydrogen per 100 Grams
99.99%	nil	10.0
94.1%	5.9	5.2
88.5%	11.5	4.1
78.3%	21.7	2.1

TABLE III—Duplex Deoxidation, Phosphorus-Copper and Calcium Boride

	Per Cent							
Type of Addition	Total Added	P Added	Ca Added	B Added	O_2	P Residual	Ca Residual	B Residual
Nil	Nil	Nil	Nil	Nil	0.04	Nil	Nil	Nil
Phosphor-Copper	0.15	0.023	Nil	Nil	Trace	0.008	Nil	Nil
Calcium Boride	0.10	Nil	0.038	0.062	Nil	0.008	Nil	0.005

TABLE IV—Duplex Deoxidation, Phosphorus-Copper and Lithium

	Per Cent				
Type of Addition	Total Added	P Added	O_2	P Residual	Li Residual
Nil	Nil	Nil	0.04	Nil	Nil
Phosphor-Copper	0.15	0.023	0.01	0.007	Nil
Lithium	0.005	Nil	Nil	0.007	Nil

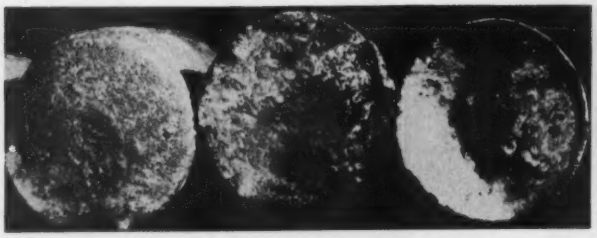

Fig. 4—Samples 12 to 14 (left to right) show progress of duplex deoxidizing technique for copper

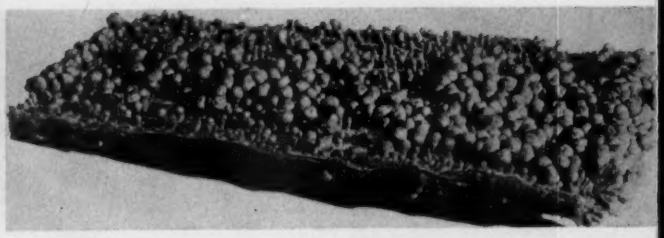

Fig. 5—Electrolytically produced cathode copper is 99.99% pure, but contains dissolved hydrogen

bined action of hydrogen and oxygen.

Two established methods to avoid porosity in copper castings have been adopted, although the reasons for their effectiveness have been explained only in relatively recent times. One requires melting the alloy under a cover of charcoal, a powerful reducing agent which prevents the melt from absorbing oxygen. It offers no protection, however, from hydrogen, which is admitted freely through the porous charcoal layer.

The second method involves melting the alloy under an oxidizing atmosphere, or flux cover, to exclude all hydrogen. This technique has the desired effect of oxidizing the melt thoroughly, but the accumulation of cuprous and other oxides can be detrimental to the physical properties of the casting.

This situation can be eliminated if, just before pouring, the melt is completely deoxidized by such elements as phosphorus to produce harmless oxides which float to the surface slag. The oxidation/deoxidation technique now is the most generally accepted practice in the casting of bronze and red brass alloys.

In the high-conductivity copper alloys, however, neither of these methods is entirely satisfactory. The reduction technique, using charcoal, fails to control the hydrogen content. The oxidation/deoxidation method is not acceptable because most of the powerful deoxidants, such as phosphorus, have a serious effect upon the electrical conductivity.

A residual phosphorus content of 0.05 per cent reduces electrical conductivity by more than 30 per cent. Of all deoxidizing agents, such as phosphorus copper, calcium, boron, calcium carbide, boron carbide, beryllium, magnesium, silicon, titanium, zinc and lithium, modern practice favors either calcium boride or lithium. Both offer the advantage that small amounts of deoxidants remaining in the melt have little effect on electrical conductivity.

Nue[3] has shown that a duplex method of deoxidizing melts of high-conductivity copper is both highly efficient and relatively inexpensive. With this method the major part of the oxygen content is removed by partially deoxidizing with phosphorus copper to a point where no residual phosphorus could exist in the alloy. Then the process is completed with an addition of specially prepared calcium boride or lithium.

The technique is a simple one which can be controlled visually. A test sample of the molten alloy is cast (Sample 12, Fig. 4) and the high gas content confirmed by the cauliflower head. Phosphorus is added to the melt until a sample with a flat head is produced (Sample 13, Fig. 4). Then calcium boride or lithium is introduced to complete the deoxidation. The sound metal is evident from the surface shrinkage in Sample 14, Fig. 4.

This method has been used successfully under production conditions and permits a saving of between 70 and 80 per cent of the expensive deoxidants without reducing the quality of the resultant castings. Tables III and IV show the results obtained with this duplex treatment.

Current Melting Practice—Pure copper is available in two forms: 1. Electrolytically produced cathode copper which is 99.99 per cent pure, but by nature of its manufacture contains extremely large amounts of dissolved hydrogen (Fig. 5). 2. Fire-refined copper, which is purified by oxidation during its processing and, consequently, may contain considerable cuprous oxide. Regardless of the type of copper he selects, the foundryman is at a disadvantage.

Experience has demonstrated that either a neutral or a slightly reducing furnace atmosphere, together with reducing fluxes containing fusible salts to provide a continuous molten cover, are most desirable during the melting cycle. This technique prevents further oxidation.

When the pouring temperature has been reached, the melt is degassed of hydrogen by flushing an inert scavenging gas through it. Nitrogen has been used for this purpose, but with only mediocre success because it is inconvenient to apply and because commercial nitrogen can contain moisture which will nullify its effectiveness.

To overcome these disadvantages, a proprietary degassing briquet has been developed (Fig. 6) which is

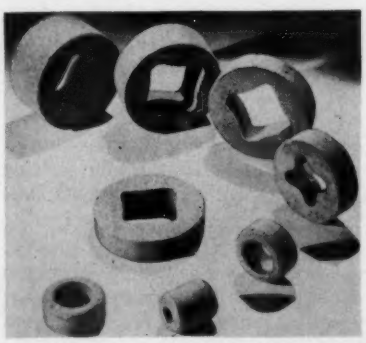

Fig. 6—Degassing briquets are applied by plunging them into melt to form scavenging gases

TABLE V—Effect of Time and Temperature on Precipitation Hardening of Copper Containing 0.6% Chromium with 0.015% Iron after Quenching from 1886°F[6]

Period of Heat Treatment (Hardness as quenched, 55 DPH.)	Diamond Pyramid Hardness after Heat Treatment for Stated Time at Stated Temperature										
	392° F	572° F	662° F	732° F	797° F	842° F	887° F	932° F	1022° F	1112° F	1292° F
2 minutes	55	55	55	56	57	..	..	..	..	112	127*
5 minutes	..	..	56	60	61	82	102	118	125	135*	110
10 minutes	..	..	58	63	67	93	116	123	140*	124	99
30 minutes	..	..	59	74	87	109	124	142	132	109	78
45 minutes	..	..	..	..	..	..	..	146*	..	..	..
1 hour	..	..	60	83	98	119	142	143	124	101	..
1½ hours	..	..	..	..	..	..	144*	..	..	..	..
2 hours	..	57	62	93	109	130	143	137	118	93	..
5 hours	..	..	66	109	126	143	133	126	110	85	..
7 hours	..	..	..	..	..	145*	..	..	..	..	..
10 hours	..	..	73	122	140	143	127	119	95	..	..
1 day	56	59	80	138	147*	137	118	110	..	..	..
3 days	..	62	92	146*	138	126	..	..	..	..	..
1 week	..	66	109	146*	129	113	..	..	..	..	..
4 weeks	..	71	133	138	118	..	..	..	..	..	..
10 weeks	57	79	147*	..	..	..	..	..	..	..	..

*Maximum hardness reached at each temperature.

applied by plunging it into the melt, where it releases scavenging gases. During this procedure, the metal is thoroughly deoxidized by the principle previously described and then is ready for pouring.

If such alloying elements as chromium are to be added, they must be introduced after the melt has been deoxidized completely. Otherwise, the alloying element may expend itself acting as a deoxidant. It then will produce chromium oxide or similar insolubles which will weaken the metal structure by appearing as inclusions in the solidified casting. To facilitate rapid alloying, chromium usually is added to the copper as a prepared master alloy of copper and 8-12 per cent chromium, rather than as a pure metal.

Heat Treatment — Of all high-conductivity copper alloys, chromium copper is the only type responding effectively to heat treatment for maximum strength and conductivity. The optimum amount of chromium which can remain soluble in solid copper is 0.7 per cent, but most alloys of this type rarely contain more than about 0.5 per cent.

If, however, the chromium remains in solid solution in the copper when the casting is in service, the electrical conductivity and hardness are impaired. The cast piece therefore is subjected to a heat treatment process[4] whereby it is first heated to about 1832° F for approximately 15 minutes, then quenched rapidly in cold water. The metal then is in the solution heat treated condition, and all the chromium is in solid solution.

Only after a second heat treatment are its desirable physical properties developed. The quenched part is reheated to a temperature between 752-932° F for at least four hours. During this precipitation hardening process, the chromium is ejected from solution as a submicroscopic precipitate throughout the copper-rich crystals.

This phenomenon takes place because copper at those temperatures can retain only 0.05 per cent chromium in solution. The deposit of minute particles of chromium has the remarkable effect of stiffening the copper crystals and restoring the conductivity to almost that of pure copper.

The effect of time and temperature, during the precipitation hardening treatment on the ultimate hardness and conductivity of the alloy is documented in Tables V and VI.[5] It should be noted that a 4-hour treatment at 842°-1022° F produces sufficient hardness and conductivity properties for most purposes, although higher values for either could be obtained, if necessary, one at the expense of the other.

Chromium copper has been established as a most satisfactory alloy for castings, forgings and wrought shapes for electrical applications. As such, it frequently is specified by engineers and designers.

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TABLE VI—Effect of Time and Temperature on Electrical Conductivity of Copper Containing 0.6% Chromium with 0.015% Iron after Quenching from 1886°F[6]

Period of Heat Treatment (Conductivity as quenched, 41% IACS)	Conductivity* per cent International Annealed Copper Standard, after Heat Treatment for Stated Period and Stated Temperature									
	392° F	537° F	572° F	617° F	662° F	752° F	797° F	842° F	887° F	1022° F	1112° F
1 minute	..	..	..	..	..	41	45	50	53	67	78
5 minutes	..	..	..	..	..	45	53	67	71	78	81
10 minutes	41	43	43	43	43	50	60	69	74	79	83
30 minutes	41	43	43	43	45	64	69	74	81	84	84
1 hour	41	43	43	45	50	67	71	78	83	86	85
2 hours	42	43	44	46	56	69	73	79	86	88	85
5 hours	43	44	45	47	65	73	78	83	88	89	85
10 hours	43	45	47	53	67	76	81	85	89	89	85
1 day	43	47	56	64	70	78	83	87	90	89	..
3 days	43	50	61	67	75	83	88	90	93	89	..
1 week	44	54	65	71	78	86	90	91	93	..	..
4 weeks	44	60	67	..	82	..	91	91	93	..	..
2 months	45	61	70	..	84	..	92	91	93	..	..
3 months	45	..	71	..	86	..	92	92	93	..	..

*Temperature of testing not stated, but presumed to be 20° C.

SAFETY Is Your Business

At Hamilton Foundry Inc., Hamilton, Ohio, a fight for safe operations has been waged for many years. This article describes what was done and what was achieved

By CLARENCE W. ROWSEY
Director of Personnel and Safety
Hamilton Foundry Inc.
Hamilton, Ohio

● THE SAFETY STORY has no ending. It is the story of a constant fight to reduce ever-changing hazards and to motivate citizens to develop safe attitudes and habits. At Hamilton Foundry Inc., Hamilton, Ohio, that fight has been waged for many years, with most encouraging results.

For the decade of the 1950s, the work force at Hamilton Foundry averaged 316 employees. During that decade, the company experienced five long periods without a lost-time injury. These included the following, in order of occurrence:

1. 533 Days—Aug. 8, 1949-Jan. 23, 1951.
2. 286 Days—May 18, 1954-Feb. 28, 1955.
3. 458 Days — Dec. 11, 1957-March 14, 1959.
4. 269 Days—March 15, 1959-Dec. 9, 1959.
5. 419 Days—Dec. 10, 1959-Feb. 1, 1961 (record still growing).

During these years, the Hamilton Foundry accident frequency rate averaged 4.8. Fig. 1 shows accident frequency rate (lost-time injuries per 1 million manhours worked) comparisons of the entire foundry industry and of all industry with Hamilton Foundry. It should be noted that these figures are for National Safety Council members only. These members normally include companies with superior safety programs. The frequency rate for the foundry industry as a whole, for example, is about double the rate shown in Fig. 1.

Safety Is Everybody's Business—Safety is the business of every citizen, a business which involves not only a man's concern for himself, but also for his fellow man. It requires organization, knowhow, action, and follow-up.

At Hamilton Foundry, the business of safety is administered by two committees, the Workmen's Safety and Hygiene Committee and the Supervisors' Safety and Hygiene Committee.

The eight-man workmen's committee, of which the director of personnel and safety is chairman, meets monthly—more often if necesary. It discusses safety and hygiene recommendation cards dropped in suggestion boxes by employees and considers any other topic involving on-the-job or off-the-job safety, departmental safety records, and inspection reports.

Over a 22-year period, as of Dec. 31, 1960, this committee discussed and took action on 7372 safety suggestions. When suggestions require immediate action, a decision is made by the director of personnel and safety and the vice president-works manager. Every suggestion is discussed with the interested employee and with the work-

Ray Coda, secondary finisher, turns in a safety suggestion at one of the boxes available for that purpose

A History of SAFETY PROGRESS

HAMILTON FOUNDRY INC., organized in 1891, considers the year 1938 one of the most important in its 70-year history. In 1938 this company launched a revitalized safety and hygiene program.

Safety promotion in that kick-off year included many features. At several meetings, attended by all employees, the safety program was explained fully, and topics on safety and health were presented by experts on these subjects.

An open house was held for employees, their families, and community friends. The company secured, and has retained ever since, membership in the National Safety Council. The employee safety suggestion system was begun. Two safety committees were organized.

Actually, 1938 did not mark the beginning of the company's safety efforts. For instance, respirators were mandatory for certain jobs as far back as 1918. Physical examinations for all employees were started in 1927 and expanded to include chest-x-rays in 1934. Eye protection was a rigid requirement for grinders, chippers, welders, and molten metal handlers starting in 1929. In that same year leggings were required to be worn by men handling molten metal.

In 1937 the first steel-toe shoes were sold to employees. Since then these shoes are required not only for all plant personnel, but also for office employees who visit the plant frequently. The shoes are sold at cost through payroll deduction.

Sparking the Hamilton safety program has been Peter E. Rentschler, company president since 1927. It is no secret that top management support, the envy of every safety man, is a necessity. The many programs aimed at soliciting executive level backing are basic curricula for many safety supervisors. At Hamilton Foundry the studies concern other topics.

A co-founder and past president of the Hamilton Safety Council, Mr. Rentschler long has been a staunch believer, supporter, and promoter of safety. His main reasons are that a good safety program is humanitarian, an expression of concern for the well being of fellow men, and that an effective safety program is good business for both employee and employer.

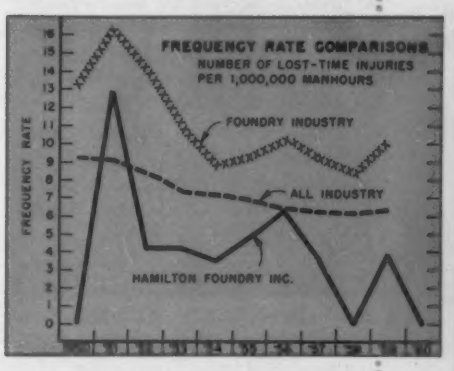


Fig. 1—Comparing accident frequency rates at Hamilton Foundry, in all industry and in all foundries

men's committee. A secretary elected by this group keeps minutes of the meetings which are posted on the safety committee bulletin board and distributed to each committeeman and supervisor.

Employees are invited to serve for 1-year terms, and membership is rotated. Rotation permits many employees to take part, brings both experienced and new members to each meeting, and insures that practically every department is represented.

Members of the workmen's committee are invited to attend the annual Butler County Regional Safety Conference. The committee meets occasionally with the plant fire brigade and at least once each year with the supervisors' committee. Monthly meetings also include discussion of safety topics as outlined by the Industrial Commission of Ohio's employee education program, "Pattern for Progress." This committee also conducts plant inspections.

Supervisors' Committee—The supervisors' committee has four permanent members — Peter Robert Rentschler, vice president and secretary of the company, chairman; Clarence W. Rowsey, director of personnel and safety, secretary; Richard R. Deas Jr., vice president and works manager; and Dennis B. Gabbard, foreman, maintenance department. In addition, it includes five supervisors who serve for one-year terms. The purchasing agent, supervisor of cost and billing, metallurgist, foundry foreman, and general plant labor foreman presently round out the committee.

This committee handles employee suggestions recommended for further action by the workmen's committee and also discusses safety and hygiene in general—at the plant, in other plants, on the highways, in homes, in schools, etc.

These supervisors meet quarterly —more often if necessary—with emphasis on attendance and active participation.

Minutes of these meetings are issued to every supervisor and to all members of the workmen's committee.

A joint meeting of the supervisors' and workmen's committees is held annually and is conducted by the company's president. The

A talk on mouth-to-mouth breathing was a feature of a joint meeting of both plant safety committees last December

1960 joint meeting for example, featured an excellent film, "Rescue Breathing," a talk by the company doctor on insufflation (mouth-to-mouth resuscitation), and demonstrations by the Hamilton Fire Department life squad.

The Program—These two committees are at the hard core of the safety effort at Hamilton Foundry, but their work takes many forms. Let's take a look at some of them.

Safety Inspections—Every safety director recognizes the value of regular inspection. At Hamilton Foundry, the inspector may be a maintenance man, but when possible he is the operator of the equipment involved. Inspection forms completed by the inspector are forwarded via the maintenance foreman to the safety department.

Cranes are inspected daily; chains and cables, trucks, front-end loaders, and a mobile crane unit are inspected weekly; certain equipment in every department, all fire extinguishers, and other fire fighting equipment are inspected monthly.

Full-time janitor service maintains hygienic conditions within the company. Lockers and other locker room facilities are cleaned every day, and this care is supplemented by a special clean-up and disinfectant treatment twice monthly.

Each department is responsible for the condition of its signs, goggle cleaning stations, salt tablet dispensers, floors, light fixtures, and general housekeeping conditions. Good housekeeping has not been on a departmental competitive basis but may become so in the future. Housekeeping is, of course, a constant policing job, and every incentive to promote good housekeeping should be considered.

Safety and hygiene inspections in the plant are conducted periodically by members of management, by the safety committees, or by special inspecting groups which have been asked to conduct them.

Finding unsafe conditions by inspections and then taking corrective action is one of the best methods for management to demonstrate to employees its sincere interest in accident prevention.

Safety Contests—Safety promotion via contests became a new and important project during 1960.

The first of four safety contests was called "Safety Faults" and got the project off to a good start. Every employee received 1) a picture of a workshop full of infractions of good safety practices and 2) a contest entry blank which included instructions and rules. The challenge was to list recommendations for correcting the unsafe conditions.

Three cash award winners ($25, $15, and $10 prizes) were determined by members of the workmen's committee on the basis of the number of approved safety recommendations submitted and originality in naming the workshop picture. The safety enthusiast in our maintenance department who won this contest listed 57 recommendations, compared to 59 infractions on the answer sheet.

Winners' pictures appeared in the Hamilton *Journal Daily News* and on company bulletin boards. An answer sheet listing the safety infractions and the contest results was mailed to each employee with another picture of the workshop on which the hazards were encircled in red. There were 40 entries, or 25 per cent participation, and this showing encouraged us to hold a second contest.

This contest, called "Safety Spirit," involved suggestions to correct safety faults at Hamilton Foundry, and our established safety suggestion program was utilized. The 107 recommendations received were convincing evidence of employee interest. As usual, each suggestion was discussed with the man who had made it, and action was taken to correct the faults. At a meeting of the workmen's committee, each suggestion was discussed and the cash award winners determined.

Minutes of this meeting, including each of the 107 suggestions and descriptions of action taken or planned, were posted on the company's special bulletin board and distributed to safety committeemen and to supervisors.

A number of the employee suggestions involved the conduct of fellow employees, such as those who failed to follow certain safety rules or to be good housekeepers. A special letter to employees' homes focused attention on these suggestions.

The target for our third contest, "Safety Wits," again was promotion through employee participation. Every employee was eligible for the contest, which was designed to produce safety slogans. The judges—safety directors from neighboring plants—had a difficult task selecting the following three best out of 127 safety slogans submitted:

1. "Safety is one of the many keys to happiness."

2. "Preach, practice and promote safety."

3. "Safety should be where you are—at work, at home, or in the car."

The fourth contest, the most successful and most recent, "Safety Calls," broadened the scope of participation to include employees' families. From the slogans received during the Safety Wits Contest, the committee selected four to be featured—one each week for four weeks—as the Hamilton Foundry Safety Slogan of the Week. Each day, for twenty work days, members of the workmen's committee took turns drawing names of em-

Fire fighters engaged in contest action are James Wilson, molder, in the circle, and Bill Browning, grinder, at the right

Left to right, Josephine Fontaine and Dr. Garret J. Boone interview Mello Day, production clerk

Timekeeper James Reumann cleans his safety glasses at one of the many stations in the plant

ployees' home to be phoned. The person answering was asked to give the current slogan. If there was not a winner after three families had been talked to in a contest day, no further calls were made.

Winners received $5, and a daily list of employees whose homes had been called was posted on the bulletin board, with the results of each call.

There was a winner 18 days out of 20. Employees' wives, children, grandparents, and friends were among those who were able to tell us the safety slogan of the week.

Records tell us that Hamilton Foundry employees are safer on the job than off. This fact emphasizes the need to continue to promote safety in the home—in fact, everywhere, all the time.

So far, we have found that contests which require thinking in terms of safe practice definitely excite the interest and participation of employees in the safety program. Consequently, our fifth contest is in the planning stage.

Awards have been in cash because there is no question that people enjoy such an award. Our philosophy is, however, that safety should not become commercialized to the extent that an award becomes a bribe which is more important than the safety achievement.

Fire Defense — The seven-man fire brigade is another volunteer group actively promoting safety at Hamilton Foundry—although the emphasis concerns fire safety. This group, our first line of defense against fires, was formed in 1946 with encouragement of the Industrial Division of the Hamilton Safety Council and the Hamilton City Fire Department.

The brigade meets on company time about once each month for fire drills, fire extinguisher practice, hose drills, and discussion of plant and home fire problems. Members of the municipal fire department sometimes attend these sessions to assist in the training. At times, our brigade meets to conduct plant fire inspections.

Members compete in the Hamilton Industrial Fire Brigade Contests and attend other programs sponsored by the Fire Prevention Division of the Hamilton Safety Council.

The company feels that the purpose of the fire brigade is not to fight and subdue large fires, but to stop fires quickly when possible or to keep fires under control until the city firemen arrive. The brigade is worth while. In addition to several minor fires which the plant fire brigade dispatched quickly and in good order, one incident occurred which might have resulted in a major fire and consequent shutdown of some of our operations except for fast action by the company brigade.

Prompt action of the plant fire brigade held the loss to a few hundred dollars and, more important, kept the damage so negligible that there was no major interruption of operations.

The Wise Owl—Since the Hamilton Foundry Wise Owl Club—for workers who have saved their sight by wearing eye protection—received its charter from the National Society for the Prevention of Blindness in December, 1952, a total of 57 employees have saved an eye by wearing eye protection. Three of them saved both eyes.

Supervisors of employees with shattered or pitted eye protection are responsible for insuring that employees report to the first-aid room for an eye check and to the store department to make exchange for new protection. Supervisors also forward a description of the incident to the personnel department.

Recently, within a one-week period, two men at Hamilton Foundry saved either one or both eyes when goggles were struck by molten metal. As always, these incidents were dramatized. Each shattered lens was displayed with a description of the incident.

Medical Care—Whether an employee's problem is a cut finger resulting from an on-the-job or an off-the-job accident, a cold, a sore throat, or a headache, the necessary treatment is available in our first-aid room, where Mrs. Josephine Fontaine, a registered nurse, is on duty during day working hours. A registered nurse has been on duty at Hamilton Foundry during the day since June 2, 1941. Howard Hobstetter, a foundry night foreman, supervises first-aid activities during his shift.

Dr. Garret J. Boone, an industrial physician who has been associated with the company since Sept. 1, 1939, visits the plant regularly and is on 24-hour call should his counsel be needed by the nurse or his presence be needed because of an industrial emergency. Telephone numbers to call during emergencies are available at every telephone.

In many instances, treatment for nonindustrial ailments has helped

to keep persons on the job, thereby lowering absentee rates. The rate of absenteeism at Hamilton Foundry during the decade 1950-60 averaged 3.25 per cent; the 1960 absentee rate was 2.26 percent.

Hamilton Foundry is proud of its new medical facilities, which allow for private treatment and include three adjoining rooms—the waiting room, treatment room, and emergency room.

In the waiting room, employees are greeted by the nurse and interviewed concerning their ailments. A complete record, signed by the employee for each first-aid visit, whether the case is industrial or nonindustrial, is maintained. If the case is an industrial injury, accident investigation forms are forwarded to supervisors involved.

Completed investigation forms must be returned within one day to the safety director, who forwards copies of this investigation to such members of management as the director of employee relations, foundry superintendent, vice president and works manager, and vice president and secretary.

Investigation forms are filed in the employees' personnel folders. Industrial injuries receive priority attention. Emphasis in every instance is on what can be done to prevent another such accident.

New employees are introduced to our nurse before being sent to the doctor for physical examination. The pre-employment medical history form and a form to be signed by the prospective employee to authorize the physical examination are completed by the nurse. Both forms are presented to the doctor by the prospective employee when the appointment time arrives.

Newly hired employees receive chest x-rays at a local hospital, and follow-up x-rays are scheduled at least annually or biannually, depending on age, physical condition, and job requirements.

The employment of physically equipped personnel is of utmost importance. There are, of course, different standards for different jobs, and the company physician is free to exercise his professional discretion in determining physical capabilities.

This point applies to either a prospective employee or an employee who visits his office for approval to return to work after a disabling illness or injury of seven or more consecutive days. A person may not get an approval for his own job, but may be recommended for a different assignment. Hamilton Foundry is proud of an award it received for employment of handicapped persons. Each year this award is presented to one company in the state of Ohio.

An important pre-employment activity is a check of previous work records. Should such investigation uncover a poor attitude towards safety in an individual, he may not be hired.

Adjoining the waiting room is the treatment room. The emergency room also adjoins the waiting room. It is accessible directly from the plant area and allows for complete privacy. This room is reserved for true emergency cases and for cases requiring isolation due to acute illness. Employees can be transported easily from the emergency room to an ambulance without disturbing other personnel.

Safety Guideposts—The road to reduction of human suffering and financial loss due to industrial injuries is never-ending. Committees, Wise Owl Clubs, first-aid rooms, etc., help to pave this road, but road signs also are needed to tell us whether we are going in the right direction and where the road is bumpy. Taking out the bumps requires a study of the terrain. Periodic reports and inspections are parts of this study.

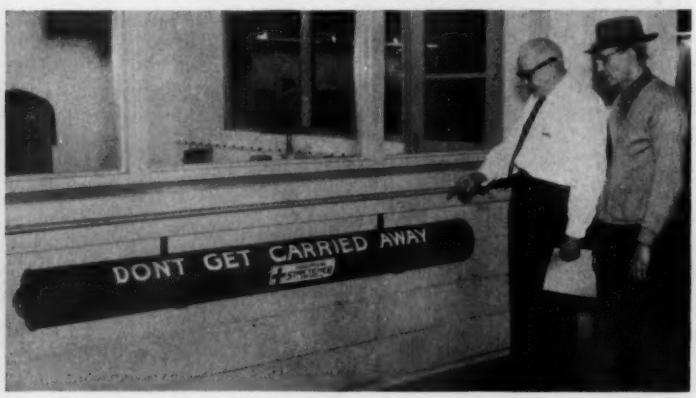
Monthly reports from our first-aid department to all supervisors list all injuries by department. Industrial cases also are categorized departmentally by nature and cause of injury. Pinpointing accident experience has paid off.

About nine months ago, for example, a study of first-aid department reports flashed a warning signal: "Too many eye cases in the clean and ship department." This finding surprised us because by decree of management, at the recommendation of the workmen's committee, this department has been off-limits to any person without eye protection since 1939. When the increase in eye cases was noted, we therefore questioned not the wearing but the fitting of eye protection.

We asked an optician to check the fitting of men who were experiencing the most difficulty. (Prescription safety glasses have been provided employees by the company since 1946.) The eye

Safety sign on muller is designed to keep employees who work in the area on the alert for danger

R. R. Deas, Jr., vice president-works manager, left, and Clem Henry, clean and ship foreman



Safety display alerts employees to the need for constant care

protection of 23 men was checked, and adjustments were required by nearly all. Several employees required and were fitted with a different type of eye protection.

Recently, on Sept. 30, this service was repeated. The optician and the writer visited the work stations of 43 men in the Cleaning Department—the original group plus 20 others. Only six adjustments were necessary. The figures in Table I indicate improvement, but our goal is to have no cases at all.

In addition to reducing eye cases, this personal attention and service enhances an individual's feeling of job importance. A sincere concern for the employee also promotes interest in the safety program and good will toward the company.

Periodical analysis of established monthly reports, as this example demonstrates, shows where the bumps in the safety road are and what can be done to reduce them.

The Outside Story—The safety story told by other organizations is of much interest to Hamilton Foundry.

The National Safety Congress, sponsored annually by the National Safety Council, is attended by company representatives every year. Such National Safety Council publications as the *Accident Prevention Manual for Industrial Operations*, its monthly magazine *National Safety News*, posters, flip charts, and other materials assist our program.

Activities of the Hamilton Safety Council also are supported 100 per cent by the company. The program of the Hamilton Safety Council is supported unusually well by Hamilton Foundry employees. This spring, for example, 278 out of 280 employees purchased Safety Council associate memberships. This figure represented the highest percentage of industrial employee participation ever in the city of Hamilton.

The All-Ohio Safety Congress, sponsored by the Industrial Commission of Ohio, is another safety event attended by representatives of the company.

The Gray Iron Founders' Society, winner of the National Safety Council's Association Award for 1960, also tells a safety story of interest to our company. This society surveys members' safety activities and insurance rates, collects and analyzes accident statistics, and provides materials and consultation to members.

In citing GIFS for the 1960 award, the National Safety Council released figures to show that the disabling injury frequency rate of the industry was reduced 19 per cent for 1954-58 and 8.7 per cent in the last year alone.

The company also belongs to the American Foundrymen's Society, which through its Safety, Hygiene and Air Pollution Control program has rendered valuable service. The SHAP program has provided engineering manuals covering such topics as control of in-plant environment, control of air pollution, safety practices, control of welding hazards, abatement of noise, etc.

Hamilton Foundry has been a member of the National Fire Protection Association for many years and finds the NFPA National Fire Code volumes, monthly and quarterly publications, and posters to be helpful.

Naturally, there are times when we hear the same story, or see the same exhibits, but there always is the possibility of finding something new which could turn out to be of value.

Telling the Safety Story—In any safety program, the chief goal is to maintain a continuing awareness of safety problems. At Hamilton Foundry, special displays, signs and posters, regularly posted

TABLE I—Eye Cases, Clean and Ship Department

(12-month period, Jan. 1-Dec. 31, 1960)

Month	Total Eye Cases	Doctor's Cases
January	10	1
February	24	3
March	13	1
April	18	4
May	3	1
June	6	1
July	8	0
August	8	1
September	5	0
October	7	0
November	7	1
December	4	0

statistics, meetings, and booklets are a few of the devices used to tell employees about safety.

Safety articles also appear regularly in the president's shop letter, "To Hamilton Foundry Men and Women," and in the company's semimonthly publication, *Casting About*. The writer, as personnel and safety director, writes "Safety Zone," a column which appears regularly in *Casting About*.

It not only covers activities of plant safety committees, but also discusses the Hamilton Safety Council, plant and home fire prevention, eye protection and care, driving in school zones, home heating unit inspection, plant inspection by safety advisors of the Division of Safety and Hygiene, Industrial Commission of Ohio, and other timely topics.

Newspapers and magazines periodically have published information about safety progress at Hamilton Foundry. Such clippings or articles are posted throughout the plant so that employees can appreciate the accomplishments they have helped to make possible. Our safety story also has been told to school and other public groups which have accepted invitations to visit with us.

At Hamilton Foundry we are looking to the 1960s for even greater safety progress. To inspire this progress, our company subscribes to the creed of the National Safety Council:

> **"Safety is positive . . . It is doing things the right way . . . It is interest in the welfare of others . . . It is a contribution to good living, to good government and respect for law and order, to efficient production, and to the well-being of every individual."**

● For an extra copy of this article, until supply is exhausted, use card on Page 39

Research and Gray Iron Castings

The vital need for research by the gray iron foundry industry is pointed up in this article based on a talk presented at the annual meeting of the Gray Iron Founders' Society last October

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● NO PHILOSOPHICAL arguments are advanced in this article for research for research's sake, for research as a means of increasing the American standard of living, or for research as a means to a brighter tomorrow. The discussion is concerned with the relationship between research and the sales and profits of gray iron foundries.

About 20 years ago, I became a foundryman and put in time with a shovel and rammer. Although I now work in a research institute, and qualify as an egghead to those still in foundries, a goodly portion of my time still is spent on drafty charging decks and with sweaty moiders. Because of this, foundrymen call me a scientist, and scientists call me a blacksmith. Be that as it may, it has provided a chance to see both sides of the relationship between foundries and research.

In the short 15-year period that I have been associated with research, the annual rate of expenditures for industrial research in the United States has increased ten times, until research expenditures have reached about $10 billion a year.

An activity growing as rapidly as research obviously is doing so because it has something to offer. That something, if we define it in one word, is change. If we accept change as a desirable and marketable commodity, we then should examine the gray iron industry to determine how much it has changed in recent years.

Resists Change—We find that the gray iron industry has resisted rather than embraced change. This is not hard to understand. The foundry industry is thousands of years old. During this time, tradition and precedent have become firmly entrenched. Research and foundries almost are natural enemies. One proposes change and the other is stabilized by precedent. Precedent and change, each in its proper place, are admirable and valuable things. In the wrong place each is a dangerous and costly thing.

Because we will be talking about research, let's define it for the present purpose: "Research is the type of original thinking and action that precedes the birth of a new product, process, or industry, or the death of an old one."

Notice that research does not include testing sand for control, pulling test bars to determine compliance with specifications, buying full-page ads in magazines, making movies, or holding clinics for salesmen. It also does not include laboratories or engineers if they are involved primarily in solving day-to-day problems, or in trying to take a pattern away from another gray iron foundry. But, research does include learning how to do each of these things better.

At Battelle we see and participate in tremendous efforts by backers of various materials and processes who are trying to change or displace old and established materials and processes. Such experience with research and its results teaches that it is not adequate to identify a need and then go to work on it. Future needs must be anticipated, or, better yet, created. A problem must be identified early and solved your way before someone else solves it his way.

It Takes 8 Years—The average time from the start of research on a new material or process to first commercialization is about eight years. This means that you can start a program today with expectations of results in eight years, but you can fail completely because today someone else is already four years into his program and will be on the market when you have four years still to go on yours.

Here's one example of what this

Fig. 1—Projected shipments of gray iron castings by U. S. foundries

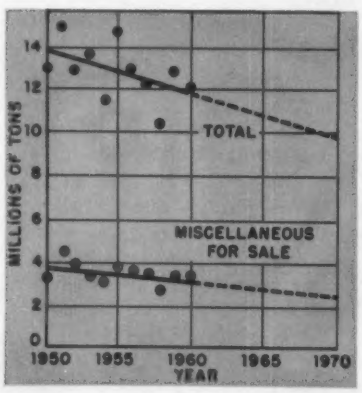
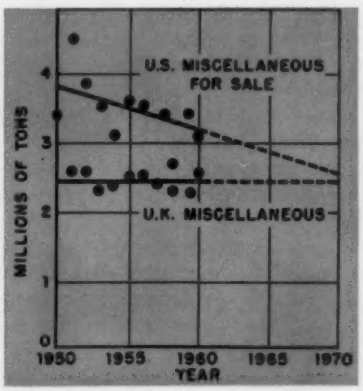


Fig. 2—United Kingdom and United States gray iron castings shipments



means to gray iron foundries. Certain foundries are starting to hurt or expect to be hurt by the aluminum engine for automobiles. Right now they are feeling the early effects of research programs started more than eight years ago. Although you feel that you are hurting now, there are new developments in this area that haven't been tossed at you yet.

The spectre of an aluminum block doesn't bother many foundries. Comparatively few iron foundries make engine blocks, so who cares if these few lose some business? Once the block problem is licked and converted to aluminum, however, the trend will not stop there. Success with the block will put the aluminum industry in a very strong position to raid away designs and patterns that you have had for generations. Nonchalance about the block situation is second only to outright encouragement of your most capable competitor.

Three Questions—Before you decide what you personally should promote and support in the way of a research program, you must answer three important questions.

The first: "What is the evidence that the gray iron industry needs more research?" Most of the answer comes from the Charles Edgar Hoyt Memorial Lecture presented by William J. Grede at the 1960 American Foundrymen's Society Castings Congress. Fig. 1 shows that total shipments as well as shipments of miscellaneous castings have decreased in the last decade.

Fig. 3 shows how change in the gray iron index compares with two other indexes of interest.

The question, "How does gray iron stack up with other cast materials during this period?" is answered by Fig. 4. The data indicate that gray iron lost substantially during the last decade in its competition with other cast materials.

What does this have to do with research? The answer is that competitors of the gray iron foundry industry have invested in research at a constantly increasing rate to take away some of the traditional gray iron castings markets and to weaken gray iron's position in many new markets.

Fig. 5 gives the estimated expenditures for research by different manufacturing industries in the United States. In addition to the amounts shown, the federal government spent over 1.5 times the amount spent by industry.

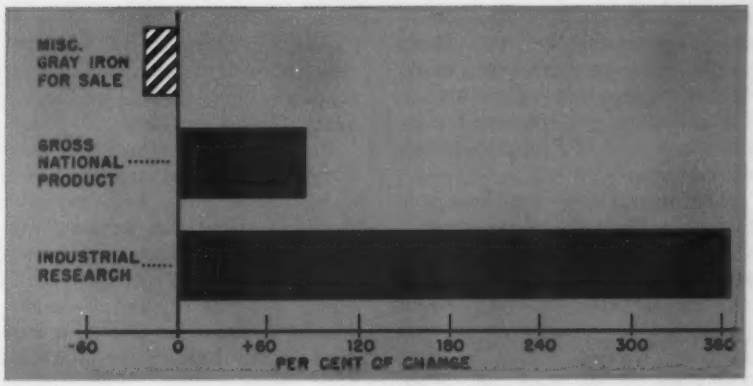


Fig. 3—Per cent change in three indexes during one decade is compared

Look at Growth Industries—The data in Fig. 5 show several things. First, the growth industries invest the highest percentage of income on research. This is the reason that they are growth industries. Second, the industries that sell very large volumes of stable low-cost products (petroleum, primary metals, and food) invest a smaller percentage of their sales on research. Because of their terrifically high sales figures, however, their total dollars invested in research are very high. Third, an industry had to invest in 1960 about 2 per cent of its sales to keep up with the average American industry. Only four years ago this figure was 1.3 per cent. Today it is 2.1 per cent. By 1965, it is expected to be about 3.5 per cent.

With this background on what others are investing in research, let us look at what the gray iron industry is spending. Specific figures for the entire industry can not be given because none have been collected. Fig. 6 gives an estimate for some foundry organizations that the foundry industry considers to be research conscious.

In Fig. 6 one group stands out as a bright spot, but it includes only six companies in the malleable industry. Even this group, with a budget that is very large by foundry standards, is investing in research at a rate that is only 20 per cent of the average for all U. S. industry. Taking the gray iron industry as a whole, it is certainly spending on research only a few cents per $100 of sales.

Such facts and figures lead inescapably to the conclusion that foundry research is lagging manyfold behind that of its competitors.

Foreign Research—Someone now probably is eager to point out that the situation is not as bad as painted here. After all, the last 10 years have seen a lot of new things come into the foundry. As a mental exercise, however, picture your foundry without any of the following materials or processes: Shell molds and cores, CO_2 hardened molds and cores, air-set cores, core shooters, water-cooled cupolas, injectors for borings, Shaw process ceramic molds, and Parlanti process permanent molds. Each of these was originated outside the United States in countries where foundry research is recognized as necessary to growth.

Ductile iron, which could be included in this listing, deserves special mention in that it raises a question about our ability to exploit a new material. A pertinent question is: "Given a new material or process, will the gray iron industry take advantage of it?"

Some gray iron foundries moved fast to get into the production of ductile iron soon after its announcement in 1948. But we are producing less than 200,000 tons a year.

Five years ago a 1960 production of over 1 million tons was predicted. That tonnage never was reached because the necessary research has not been done to find out how to use this material to best advantage. We are waiting for de-

signers, engineers, and scientists to give us a market for it. Those people, however, have other materials on their minds. They are using aluminum, concrete, and plastics where we might have sold them ductile iron.

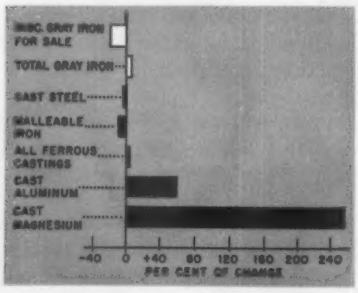
The new Gray Iron Founders' Society public relations program is a real contribution to better understanding of cast iron by people outside the industry. As part of this program, the advantages of gray iron are stressed. That is good, and needs to be done. However, the characteristics that really limit the gray iron market should not be ignored.

Get Up to Date—Whether we will admit it outside a foundry or not, many gray iron castings are overweight, weak, brittle, rough, and dimensionally inaccurate. Of course, they are better in all of these characteristics than they were ten years ago, but we are no longer competing with 1950 materials and 1950 prices. Today we are competing with 1960's myriad of new processes, new materials, and new prices. No company in an industry is likely to succeed in the future unless it gears its actions in 1960 to the conditions that will exist in 1970.

This public relations program leads directly to the next point—a quotation from an editorial in *Gray Iron News* for August, 1960: "The coke producers are sponsoring our new film program. They and other foundry vendors will be making possible a public relations program."

A pertinent question here is: "Why does the foundry industry continue to stand by its traditional position of letting its suppliers and vendors solve its problems?" Other industries, such as mining and railroads, that have put their future into the hands of their suppliers have proved the inadequacy of the method.

Fig. 4—Changes in demand for cast metals in one decade are compared



Reconstruct what happens when a typical foundry encounters a production problem. Let's say that this one is pinholes in gray iron castings. What does the foundry do? The usual procedure is to blame it on one or more of the materials used and to call in a supplier or suppliers. Why is it that after foundries have been making gray iron castings for thousands of years we can not promptly diagnose and eliminate a case of pinholes?

The answer is that the industry has ignored the research necessary to find the cause and remedy. We are waiting for someone else to find the answer. Unfortunately, however, that someone else is now hard at work trying to make some other material replace the iron.

Gray iron foundries today are competing among themselves for a share of a shrinking market. They are not competing successfully with the people who are causing the market to shrink. You may think that you are competing outside your own industry, but this is largely self-delusion. Your real opposition can see that your lack of activity in research makes their own eventual victory only a matter of time. Perhaps that statement will brand the author as a pessimist. If it does, please remember that Elbert Hubbard said that a pessimist is only a man who has been too intimately associated with optimists.

What To Do—The evidence presented up to now leads logically to our second major question of the day. It is: "What should the gray iron industry do about its present position in research?"

The obvious answer is—do more research, lots of it. How much more is partially a matter of arithmetic.

The average industrial company in the United States invested about 2 per cent of its sales dollar in research during 1960. If gray iron were in an average position and wanted to stay there, 2 per cent of sales is the amount it should budget. For the entire gray iron industry this would have been about $60 million for 1960. Subtract from this the amount actually spent and the remainder is the additional amount the industry should have invested in research.

	Per Cent of Sales	
INSTRUMENTS	5.5	
ELECTRICAL EQUIPMENT	5.4	
CHEMICALS	4.1	
AIRCRAFT	4.0	
MACHINERY	3.2	
RUBBER	2.3	
AVERAGE FOR ALL MANUFACTURING		2.1
FABRICATED METALS	1.9	
PETROLEUM	1.3	
PRIMARY METALS	0.6	
FOOD	0.4	

Fig. 5—Research expenditures by industries in 1960 are estimated

Actually the $60 million would cost only about $30 million. This is a bargain any way you look at it. Research expenditures are an expense item for bookkeeping purposes. It doesn't all come out of profits. The federal government essentially matches your investment dollar for dollar.

The program should be started at once and should be organized to continue for at least ten years without interruption. The research budget should increase annually in proportion to the annual increase in the national average for industrial research.

Hollow Objections—Foundrymen can raise all kinds of objections to a research program. Here are some common ones and the answers:

"Research is a gamble." This is true. All business enterprises involve risk. Research, however, is the best gamble you can make. The odds are all in your favor. For each dollar that you put into research, you might lose that dollar. But if you put enough dollars into a suitable program, the chances are that you will get $10 back for each one invested.

James Zeder, director of engineering and research for the Chrysler Corp., summed up the situation neatly when he said, "The greatest gamble a company can make is to have no research program at all."

"Research isn't p r a c t i c a l." Neither are babies. They are costly, noisy, dirty, and have no practical value. They net no return on the investment for 20 years, and even then they may be a liability

	Number of Companies	Est. Sales, Million Dollars	ESTIMATED RESEARCH EXPENDITURES		
			Total, Dollars	Per Co. Per Year, Dollars	Per Cent of Sales
STEEL FOUNDERS' SOCIETY	126	370	100,000	800	0.03
GRAY IRON RESEARCH INSTITUTE	17	250	68,000	4,000	0.03
MALLEABLE R AND D FOUNDATION	6	100	400,000	67,000	0.4
AMERICAN FOUNDRYMEN'S SOCIETY	4000	6,000	50,000	10	NONE
GRAY IRON FOUNDERS' SOCIETY	400	720	NONE	NONE	NONE
GRAY IRON INDUSTRY	2400	3,000	UNDER 1,000,000	UNDER 400	UNDER 0.03

Fig. 6—Estimated expenditures for research during 1960 by some foundry groups. The estimate is in total dollars, dollars per company, and per cent of sales

rather than an asset. There are many reasons for not having babies and for not doing research. The results of yielding to these superficial reasons are the same in both cases —a dim and declining future climaxed by extinction.

"Research takes too long." It does take a long time, but what is too long? In ten years it is going to be 1970 whether you do research or not. With research starting in 1960, 1970 could be a bright year for iron foundries. Without research, 1970 will be a dismal year even for the surviving foundries.

"Research costs too much." Research is expensive. So are Cadillacs, air conditioning, and annual meetings, but the return from research is greater.

Here's an illustration of how much research does cost. In 1960, the cost of maintaining one professional engineer or scientist in a suitably equipped laboratory with appropriate services ranged from about $25,000 to $60,000 a year, and the cost of setting up his laboratory is about $40,000 to $50,000 additional. These costs will not decrease.

Productivity Factors—When you consider the size of the investment needed to mount an effective research program, you undoubtedly question the wisdom of putting your money into something as intangible as research when you need it so much for tangible items like molding machines, cranes, and cupolas. To help you reach a decision on this, you can refer to several recent major studies of factors that affect productivity.

For years it has been the theory that productivity is determined by three factors—land, labor, and capital. In the last few years, however, new studies have shown that conditions have changed to the extent that a fourth factor is equally important. The fourth factor is innovation, and innovation is a product of research.

The effects of research on technology and business have been so pronounced that the textbooks on economics are being rewritten to cover it. With a factor so important that it now ranks with land, labor, and capital as contributors to productivity, no industry any longer can neglect research and stay abreast of its fellows.

The last of our three major questions is: "What could a positive research program do for the gray iron industry?"

Probably nowhere in the United States does this industry have a more staunch supporter than the magazine FOUNDRY. Let me quote from one of its editorials: "Work should be under way to study future demands to determine what the industry will be called upon to supply ten or fifteen years from now."

Be a Leader—On the surface this sounds the same as my argument. There is, however, a basic difference. FOUNDRY asks that you determine what you will be called upon to supply. It assumes that you will continue to think in terms of meeting demands and requirements set up by factors outside your industry. With a strong research program, your industry could rise from a position of being a follower, and could become a leader in our future industrial economy.

The foundry industry needs a research program broad enough to do something more than replow old ground searching for possibly overlooked treasures. To be successful under today's conditions, the program must be broad enough to explore the dark corners that have been too scary up to now. Just as a jet engine operates on an entirely different principle from a piston engine, and a transistor operates on an entirely different principle from a vacuum tube, we need to develop new foundry principles rather than simply try to beef up what we already have.

A Statistical Picture—My earlier reference to a trend of decline in the gray iron industry now deserves some specific figures, plus a look at the future.

In 1951 the gray iron industry shipped a record-breaking 15 million tons of castings. In 1952, the President's Materials Policy Commission forecast a future involving shipments of 22 million tons of gray iron castings by 1975. Right after that prediction, however, the traditional pattern for the industry started to change.

Shipments for the period from 1950 to 1960 are plotted in Fig. 1. The trend lines were calculated by accepted statistical procedures. The trend is unmistakably downward. If it continues, it predicts total shipments of 9 to 10 million tons in 1970. The decline for miscellaneous castings for sale indicates annual shipments of only 2.4 million tons by 1970.

Fig. 1 might lead some people to rationalize that the decline during the last ten years was inevitable. I do not believe that this is so, but I do believe that it was an inevitable result of inattention to research at a time when other industries were stepping up their research efforts year by year.

In Fig. 6 we estimated that the gray iron industry in the United States is spending less than about 0.03 per cent of its sales dollar on research. United Kingdom statistics indicate that, although the rate of research on gray iron by UK foundries also is low, on a comparable basis their research effort is about seven times ours. Fig. 2 shows how their shipments of miscellaneous gray iron have fared. Their shipments have held steady while ours have declined (see Fig. 1).

The gray iron industry in the United Kingdom expects to set a new record this year for castings

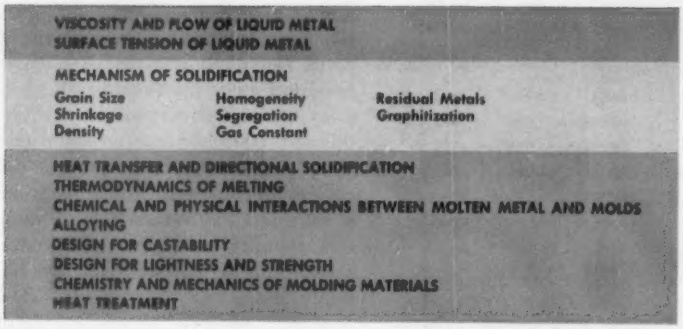


Fig. 7—Suggested subjects requiring additional study on a fundamental basis

shipments. The only other foreign country on which I have been able to get up-to-date statistics is Belgium. Although its gray iron industry is small by our standards, its shipments in 1959 were 4 per cent higher than in 1950. An ocean doesn't make this much difference in technology and acceptance, but research does.

What To Research—Up to now, I have made no suggestions on what you should study in your research program. The decision to do something must precede the selection of what to do. However, there are several types of research that must be included in an effective program. Here are the most important ones:

Metallurgical Research — This is the type of technical and scientific activity that comes to mind first when research is mentioned to foundrymen. This is the type of research that develops new gating systems, new risering systems, new alloys, new methods of melting, new methods of molding, and new designs, and tells how to avoid metallurgical defects in castings.

Engineers and scientists who have studied your situation agree that new information is needed on many aspects of the fundamentals of foundry practice. Fig. 7 outlines some of the subjects that must be studied intensively on a fundamental basis if the gray iron industry is to become a healthy growing organism.

Perhaps it will be easier to visualize the nature of the objectives by defining one in foundry terms —a permanent mold for casting gray iron. There is only one reason why we can not diecast gray iron today. There hasn't been enough research to learn how.

Systems Research—Systems engineering is a relatively new science that involves the application of mathematics to processing operations. It is a sophisticated type of research that leads to automatic operations and lower costs for labor. It is the type of research that involves the use of electronic computers instead of slide rules.

Systems engineering permits getting the most out of present processes while new things are being developed through metallurgical research. The closest activity now in a foundry is a quality control system, but the difference between a quality control system and systems engineering is about the same as the difference between one molding machine and a foundry.

One result of systems research is the development of an electronic computer to calculate and control batch mixtures for the manufacture of ice cream. With some additional study, a device of this type could calculate cupola charges and control the charging system. The basic work on the design for such a computer already has been done.

Special purpose computers can be designed to handle many foundry tasks. Buying a computer isn't necessary. The services of general purpose computers and special purpose programs are available on a rental or contract basis from many sources.

Logistics Research — Logistics is a science that includes figuring out the best way to move raw materials into your foundry and to move castings to your customers. As an area of potential saving, it is given inadequate attention by foundries.

Iron foundries are required to pay for the movement of many tons of relatively low-cost materials and products. This is the situation where logistics studies pay their highest dividends. Individual foundries can do something about their own logistic problems, but this is infinitesimal compared to what the industry might do on an integrated basis.

Market Research — Market research and sales promotion frequently get mixed up, but they are quite different in technique, intent, objective, and degree of sophistication. Selling is the art of getting people to exchange money for your product. Market research is a scientific effort to discover, arouse, and satisfy customer needs. In the case of foundries, market research and metallurgical research often become intermingled and are mutually complementary.

Market research reasonably could include a study of how the price for gray iron castings is keeping pace with national averages. Is gray iron selling each year at relatively less or more than other materials? There is the possibility that the industry has become so involved in internal competition that it has permitted profits to be driven down to the point where it can not plow back into research the money needed to protect its future.

Weight is another matter we should place high on our list of priorities for market study. Modern design emphasizes the importance of high ratios of strength to weight. A casting with a strength of 30,000 psi and a wall an inch thick isn't even going to get a passing look from many designers. With rising costs of transportation, even the weight of static structures is beginning to receive close attention.

The City of Philadelphia recently ordered stainless steel rapid transport cars to replace cars of unalloyed steel. The major reason was lightness, not appearance. You undoubtedly have noticed the ads for aluminum beer cans. Aluminum costs more per pound, but shipping costs are reduced enough to offset this. The major steel companies are spending millions of dollars to make tinplate thinner so that it will be lighter.

Have you heard about A-36 structural steel? It sells for more than ordinary grades because it is 10 per cent lighter for the same

strength. You have three choices on a trend like this—join it, fight it, or ignore it. Of the three, only the third is certain to be wrong.

An association whose members are losing sales at a rate of about $30 million per year certainly must find out why, even though the cost of the knowledge comes high. Why are substitutions being made? What specific changes should be made? What proportion of the market is irretrievably lost? What proportion might be recovered? What is needed to open up new markets and establish new demands? Answers to these questions can guide the balance of your research program.

Conclusion—Let us refer now to the two final sentences in Mr. Grede's 1960 Hoyt lecture: "There are some discouraging aspects about certain portions of the foundry business. If we approach the future with enthusiasm and vigor, I am sure that we will survive and grow."

With the first sentence, we must agree. There certainly are some "discouraging" aspects.

The second sentence is harder to analyze. It suggests that the multibillion dollar threat of research by others can be held off by enthusiasm and vigor. If true, this is still to be proved. Perhaps the reverse is true. Perhaps enthusiasm and vigor have clouded the real issue. It is revealing that in his closing sentence, Mr. Grede elected to raise the question of survival.

Everyone familar with industrial patterns recognizes that changes will occur. New materials will come in and old ones will disappear. The gray iron industry already has passed up a large proportion of the time allotted to it to prepare for the future. My suggestion is to avoid wasting the rest of this time.

Some of the facts and interpretations in this discussion are new, but the basic and fundamental appeal is not new. Consider the following quotation as it applies to today's situation:

"Possibly no industry in this country will benefit more from research work than the ironfounding trade. In the past it has occupied anything but a creditable position among the manufacturing industries of the country; very little progress has been made from a scientific point of view, archaic constructions and antiquated methods are tolerated complacently by employers, and in consequence there is a tremendous amount of leeway to be made good before the foundry can be raised to its proper position among the leading industries of the country."

This is a portion of an editorial that appeared in the *Foundry Trade Journal* (England) during the year that Warren G. Harding was elected president of the USA, the year that the 19th amendment to the Constitution was passed to give women the right to vote. The year was 1920.

Looking Ahead with Research

The following article consists of a letter received from Professor Taylor in answer to a request by the editors for examples of how basic research has aided the foundry industry

By HOWARD F. TAYLOR
Professor of Metallurgy
Massachusetts Institute of Technology
Cambridge, Mass.

● A DISTINCTION exists between research and basic research as we look upon the two terms here at MIT. Basic research is a long-range effort dedicated to an ultimate understanding of the underlying, scientific truths upon which may depend a vast number of causes and effects. As an example in metal casting, we might undertake separate short-range researches on the problems of hot tearing, internal shrinkage, and macrosegregation and by processes of trial and error bring about some relief from these maladies. But we would then have only superficial understanding as a basis for permanent cures.

This might be termed research or, perhaps more properly, development work; as an alternative approach we might look at all three problems from a fundamental viewpoint on the expectation they were overtones of a more basic phenomenon, solidification. By spending several years in really understanding the basic elements of solidification, we might be able to cure all three maladies permanently, and have a full understanding of why we were able to do so.

Now, if we can delineate the meanings of research and basic research in this manner I think you can quite readily see why I am hard put to show how the latter has benefited the foundry industry much to date. In the first place, there has been relatively very little basic research done, and what has been done has been harder to give away than the proverbial gold brick.

No Appreciation—Because of the almost utter lack of "technological cohesiveness" and real appreciation of the value of basic research among foundrymen as a group (their technical associations notwithstanding), there is no financial support and little moral encouragement for such work from the industry. Even when the work is done and paid for at no cost to the industry it takes a great many years for foundrymen to realize that the

gold brick is solid, and real. There are but very few examples I can use to show how basic research has helped the foundry industry.

One of the early contributions that comes to mind is the work on cast irons by Dr. Al Boyles. This was a painstakingly careful and basic work by a real scientist and, particularly for such relatively early times in the history of metallurgy, was a real classic contribution that has stood the test of time. It was no short range effort but a real scientific job carefully done. Our industry has found use for this work but not nearly to the extent it should have and recognition for this fine job has not been in proportion to its real and potential significance.

Another piece of work, not only classical but revolutionary, comes quickly to mind. The basic research that was the "metallurgists' dream come true"—making the flakes of graphite in cast iron spheroidal rather than elongated and thus finally breaking the barrier of brittleness in as-cast-iron. This was the invention of ductile iron, simultaneously and by different methods, by Morrogh of the British Cast Iron Research Association and Gagnebin, Millis, and Pilling of the International Nickel Co.

What Happened?—How was this invention received by a large segment of our foundry industry? It was received by skepticism and by withholding acceptance and utilization while seeking a way to break the patent. Our steel foundrymen considered it a threat to their industry as did the malleable iron people, and each did its best to prove it a presumptuous and unworthy newcomer. Our technical societies refused it a place of stature in its forums and round-table discussions among the other metals.

Only now, after ten years, and a million or more dollars spent in promotional effort, is ductile iron taking its rightful place as a tonnage material of the future. How much better if our industry had immediately backed this great invention and pushed it from the beginning, rather than collectively and individually trying to drive it into oblivion?

Another example of unexploited basic research is the work we have done at MIT on "ultra high quality" cast aluminum. As a result of about eight years of basic research we have determined the fundamental reasons for lack of strength and ductility in everyday commercial cast aluminum, determined how to overcome these shortcomings in the laboratory, and reduced our findings to fully practical production techniques.

This information has been published in its entirety and is fully available to all, but so far industry has shown only cursory interest and enthusiasm. Those foundries that have shown interest make a

Where are the entrepreneurs to carry the basic research ball?

compromise effort at real quality and balk at doing the job with the engineering care required. Industry awaits the sanctions of the consumer by way of increased prices and enhanced specifications and the consumer awaits a dependable source of supply.

Who's Aggressive?—Where are our entrepreneurs in metal casting? Are they in the foundries, in the ranks of designers or fabricators, or still in school? Who is to carry the ball? In nearly every case of progress in the foundry industry that I have seen to date it takes sanctions by the consumer to make the producer quality conscious. It is time for a change! It seems to me a wide-awake industry would show what it could do quality-wise and then sell an improved product for a premium price.

Since I am not able to present an impressive case for how basic research has helped our foundry industry to date, I will attempt to show one reason why it hasn't. Until the last three or so years, it has been impossible to find a foundry technical journal in America willing to publish the results of basic research. Unless the conclusions of such researches were simple to comprehend and obviously of immediate practical significance, they lacked readership interest.

Even our technical societies balked at printing the results of "long haired" research; trade magazines refused to accept the "stuff on cloud nine." Yet this is the very stuff from which came atomic energy, terrestrial guidance for air travel, transistors, penicillin, and a hundred other wonders of our age. The economic motivation for this blackout by the technical press was apparent. The articles probably wouldn't have been read, or understood, by more than a small percentage of our foundrymen. But that would have been a start, and, what is more important, our publication would have lent moral courage to the few persons who were engaged in basic research in this reasonably unrewarding field.

Need Publicity—Perhaps we can say "all's well that ends well" because publication of such research now can be done relatively readily, but there is no doubt it was a great deterrent to the past technological progress of the foundry industry. It may seem "Thou doth protest too much," perhaps, but it is the only way I can show clearly why basic research has made only meager inroads on our foundry industry.

We must quickly right this wrong to meet the industrial challenge now upon us. We must make consumers casting conscious! Right now they are not only relatively casting unconscious but quite generally casting anticonscious.

So much for basic research. By discussing some of the ways in which research, as distinguished from basic research, has helped the foundry industry, and extrapolation and observation of the rapid progress of other industries through utilization of the results of basic research, we can look toward the time when the foundry industry lifts itself by its technological bootstraps and is no longer low man on the materials totem pole. If basic research has been discouraged and, for the most part, kept from having a telling effect on our industry, at least short range research, by dint of much driving by the researchers, has had some real effects.

I must emphasize that my definitions of research and basic research, or perhaps more properly short range research on practical

problems of immediate interest versus long range research on a more fundamental and theoretical plane, does not imply any disparagement of the former in favor of the latter. Each has been done by men of equal interest, ability, and enthusiasm; each has its place, and each should be recognized as important.

I do feel, however, that basic research has the better chance to develop the big technological breakthroughs in metal casting so badly needed to enhance the prestige of founding and to bring its importance as a basic industry into proper focus for engineers, designers, and the general public. It should be more actively supported and encouraged.

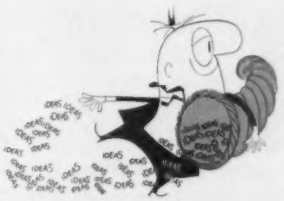
Think Back—I had the good fortune and interesting experience to begin my professional life in the foundry industry in 1937 as a fledgilng researcher at the U. S. Naval Research Laboratory. This was the time when Messrs. Briggs and Gezelius were at the peak of their research endeavors on steel castings and, among other activities, were spreading the gospel of radiography to the industry.

It was interesting to note the gradual, but painfully slow, change in attitude of the industry as a whole to utilization of this important tool. At first, there was tremendous resistance born of the absolute conviction that radiography would bring an end to the industry because unsound steel castings were as inevitable as daybreak. Over a period of six to ten years the industry attitude changed from "it will ruin us" to "well, perhaps we can live with it," to "we couldn't possibly manage without it."

The important point is that radiography had to be forced upon the steel casting industry to save it from self destruction through continuing mediocrity. Now radiography is standard practice for ferrous and nonferrous foundries alike. In its early days there simply were no eager industrial visionaries in management positions, nor do I see enough such men on the horizon yet.

More of the Same—Another big step forward came with the adaptation, again by Briggs, and Gezelius at the Naval Research Laboratory, of bentonite as a binder for washed and graded clay free sands, developing what we now call synthetic sands. Although there was ample proof that this new molding medium was a vital step forward in the making of quality steel castings, the industry was discouragingly slow to recognize yet another industrial life saver.

In fact, as long as two or three years after the initial disclosures of the work by Briggs and Gezelius, industrial criticism and standoffishness to technical papers on the subject still were discouraging. I heard Briggs make what I consider a classic observation that unfortunately



Foundrymen must seek new knowledge, and they should use it in an effective manner

still would apply to the attitudes of too many American foundrymen. After a particularly trying discussion of a technical paper, he said "Gentlemen, you may use this or not but remember, I am not motivated to this effort because I sell sand, bentonite, or water."

He was trying, as researchers have been trying before and since, to give them a bona fide 100 per cent solid gold brick. It took them ten years to peel it down skeptically, layer by tedious layer, to find it was indeed pure gold to the very center.

Other research contributions, each worthy of separate treatment, have been on directional solidification; atmospheric pressure risering; shell molding; fluid flow; principles of risering, feeding range, and thermal distribution; sands and clays; inspection techniques, and many more.

It is interesting, though, to speculate how little of this work has been at the aegis or expense of industry. It is also important to note that valuable though the work has been, we still have only superficial rather than fundamental knowledge in any of the above areas.

I may appear to have become exceedingly cynical. If so, it is only because I can see how much better our industry could be with a little added effort. I have tried to make a case for basic research, only to have it become an apologia. Basic research very simply has failed to make much of a mark on our industry.

Think Ahead—I have tried to show why this situation exists and to show where industry has been slow to encourage progress; also I have tried to highlight specific areas of neglect. Now, in all fairness, I think I should be expected to offer some constructive suggestions.

Specifically, I recommend that industry:

1. Encourage education and basic research by word of mouth, the written letter to the right people, and by personal example.
2. That it put aside money systematically to support education and research by collective and/or individual contribution.
3. That it does not wait for the supply industry, the U. S. Government, or philanthropic educational institutions to pay for research. Industry should pay for its own!
4. Industry should support the Foundry Educational Foundation and/or aid schools directly with research grants and fellowships.
5. Employ more trained engineers and use them to advantage.
6. Seek out new knowledge and use it. Industry should not wait for someone to beat a patent or prove the worth of a new idea; it should pay the tab and give every possible new idea a try.
7. Industry should have one or two long-haired sessions in its technical meetings, in which everyone does not necessarily understand everything. The price should be paid for a first class technical man who may not have a company expense account.
8. Foundrymen should read and understand the technical literature. If they do not want to do this, they should hire a man to read it and interpret it for them.
9. At all times foundrymen should bear in mind that a casting of good quality makes business and influences customers, and a bad casting is far worse than none.
10. Foundries should be progressive, impressive, and expressive.

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STEEL CASTINGS INDUSTRY

... Marks Centennial

This centennial history of the steel castings industry is taken from an address by Mr. Moriarty before a national meeting of the Newcomen Society in North America, Jan. 19

By **WILSON H. MORIARTY**, *President*, Steel Founders' Society of America and *First Vice President*, National Malleable & Steel Castings Co., Cleveland

● IN BUFFALO in 1861, Buffalo Malleable Iron Works poured the first crucible steel castings in the United States. Those castings were poured for the steel castings industry's first and largest customer—the railroads. Casting steel was unknown until 1845 when a Swiss metallurgist, Johann Conrad Fisher, exhibited some small steel castings in Europe.

In 1867, the second steel foundry in the United States, the William Butcher Steel Works in Philadelphia, later Midvale Co., was founded. This company also made its first castings for the railroad market—crossing frogs for the Philadelphia & Reading Railroad Co.

First Exclusive Producer—It was not until 1871 that the first company devoted exclusively to the manufacture of steel castings—the Pittsburgh Steel Castings Co.—was organized in Pittsburgh by William Hainsworth to cast plowshares and other steel castings for the fast growing agricultural implements business. Mr. Hainsworth held some 40 patents, and his company for a dozen years after its founding made 98 per cent of all steel castings produced in the United States.

Four other companies began the manufacture of steel castings in the '70s, but all but one fell by the way in the ensuing years. In fact, of the companies established prior to 1880, only Buffalo Malleable Iron Works—later Buffalo Steel and now the Pratt & Letchworth Div., Dayton Malleable Iron Co.—still manufactures steel castings.

In 1871, a company was established at Chester, Pa., and castings were poured directly from a cupola. They were called steel castings, a misnomer because the metal was semi-steel. A year later, however, the company was reincorporated into the Chester Steel Castings Co., which produced steel castings until 1922. In fact, the Chester Steel Castings Co. was the first of seven steel foundries that at some time operated in Chester.

Open-Hearth Melting—Even in the 1860s and '70s, there were strong indications that future applications would depend on the ability to manufacture larger castings. This goal required furnaces capable of melting steel in greater quantities. The open-hearth furnace was the answer.

Even though the first commercially successful heats of open-hearth steel were not poured in the basic steel industry until 1869, William Butcher Steel Works installed a 3½-ton open hearth as early as 1871 to produce steel castings. After 92 heats, which had not proved satisfactory, operation was halted; but in 1875 Mr. Hainsworth's company in Pittsburgh installed an open hearth that proved practical. In 1876, the Butcher Works, by then called Midvale Steel Works, installed another open hearth.

The open hearth solved the problem of sufficient capacity, and the steel casting industry was on its way. In 1860, only 11,000 tons of steel of any kind were produced in America in 13 plants, compared with more than 800,000 tons of iron. But America was moving into the age of steel. In 1864, the first commercial heat of Bessemer steel was poured in the U. S., and a year later the first steel rails were rolled in this country.

Of great importance to the steel casting industry was the invention of the air brake by George Westinghouse in 1869—with outstanding improvements in 1872—and of the railroad car coupler by Eli Janney in 1873. These two inventions played an important part in the development of our industry because the air brake made possible trains of such length that material for Janney's automatic car coupler was changed to cast steel.

The decade of the 1870s was a critical one for both the steel industry and the steel casting industry. Since steel could be obtained in larger quantities, quality became an ever-increasing factor. Improved casting followed the development by A. L. Holley of silicon to prevent blowholes. Midvale began producing steel for ordnance in 1875, and the following year introduced tensile testing as a quality control measure. It seemed as though steel was on its way as an engineering material when in 1878 the majority of rails for the railroads were rolled of steel for the first time.

Success Assured—The decade which ended with 1890 assured the eventual success of the infant steel casting industry. Less than 1700 tons of steel castings were manufactured in 1883, and in 1885 only

six steel foundries existed in the United States; but industry was turning to steel and steel castings. In 1880, not quite 2 million tons of steel were produced, but by 1890, nearly 4¼ million tons of steel were poured.

But men are more important than tonnages. Mr. Hainsworth's company in Pittsburgh had decided to try to use the Bessemer converter to produce steel for steel castings. In 1884, a 7-ton converter was installed—the first used exclusively for steel castings.

New Markets Open—By 1884, cast steel wheels for railroad cars came into use, and the first open-hearth steel was poured on the West Coast in the summer of 1884. By fall, steel from this furnace was used to make castings for the battleship *Oregon*.

The Brooklyn Bridge was completed in 1883, anchored with heavy chains fastened to cast steel anchor plates, each weighing 24,240 lb. In the late 1950s, the Mackinac Bridge —built to take the poundings of 120 mph winds, high waves, and ice jams—was built on steel casting supports weighing as much as 68,000 lb each. In all, more than 1 million lb of steel castings were used in this bridge.

New markets also took shape with the invention of the steam shovel in 1883 and the steam turbine in 1884. Steel castings were used early in both of these fields and still are used extensively in giant earthmoving and mining equipment and huge steam turbines today.

A new and important market was found for steel castings in 1888 when Mackintosh-Hemphill cast the first steel rolls in this country at its Fort Pitt Foundry in Pittsburgh. The same company was to follow its pioneering efforts and cast the first nickel steel rolls in 1896 and later to go into the casting of rolls in other steel alloys.

Green Sand Molds—In 1892, a steel foundryman was handed the job of casting 24 steel wheels of intricate design, so peculiar in shape that the wheels pulled apart in the baked molds then used.

He had to deliver the wheels in 24 hours or lose the order. In desperation, he remembered pouring the surplus of a heat of steel into an ingot mold of green sand a year earlier. His fellow workers had taken cover, for it was well known that hot metal in green sand would blow, sputter, and perhaps even explode.

Again, his co-workers raced for cover as he tipped the ladle and poured the metal into green sand molds. There was no explosion, and when the wheels were shaken out, they were satisfactory in every way.

That was a momentous day in steel casting technology. Probably it was the principal factor in the rapid adaptation of cast steel to railway use. Green sand molding did much to solve the problem of shrinkage and made it possible to cast more intricate shapes.

Manganese Steel Frogs—Another indication of the steel casting industry's fast-moving advances in the railroad field was the casting of the first manganese steel crossing frogs. The first frogs were installed in Brooklyn in 1894 at Fulton Street and Boerum Place and stood up perfectly under street car testing averaging one car every 27 seconds. It was not until January, 1900, that steam railroads accepted manganese steel castings when the same company, Taylor-Wharton Co., installed a manganese steel frog where the railroad tracks of the Pennsylvania Railroad crossed those of the Union Traction Co. at 12th Street and Washington Avenue in Philadelphia.

During this dramatic decade, other work was being done that added greatly to the science of making steel castings. A Chicago foundry owned by George M. Sargent, later to become part of American Steel Foundries, poured molten steel

STEEL CASTINGS—THE FIRST 100 YEARS

1861—Steel casting industry founded in U. S. with the pouring of railroad castings by Buffalo Malleable Iron Works. Company still in existence and now known as the Pratt & Letchworth Div., Dayton Malleable Iron Co.
1867—First castings of commercial value poured by William Butcher Steel Works, Philadelphia (crossing frogs for railroads).
1871—First company established exclusively for manufacture of steel castings—Pittsburgh Steel Casting Co., Pittsburgh (parts for agricultural equipment).
1875—Open-hearth furnace introduced in steel casting industry.
1883—First steel castings used in shipbuilding.
1883—First steel castings used in bridge building—Brooklyn Bridge.
1883—Steel casting industry produced 1684 tons of steel castings.
1884—Bessemer converter introduced in steel casting industry.
1887—First steel castings used in ordnance (gun carriages).
1888—First cast steel rolls poured.
1892—Green sand molding introduced.
1893—First railroad underframes made as steel castings.
1894—First manganese steel castings poured (railroad crossing frogs).
1896—First nickel steel rolls cast.
1898—Automatic railroad car couplers made mandatory.
1900—177,156 tons of steel castings produced in U. S.
1900—Sand blasting equipment, pneumatic chisel introduced in steel foundries.
1900—Tropenas-type converter introduced in steel casting industry in U. S.
1902—First centrifugally cast railway wheels.
1902—Steel Founders' Society of America founded.
1905—First automotive steel castings made.
1907—First vanadium steel castings poured.
1911—Electric arc furnace introduced in U. S. steel casting industry.
1913—Low frequency induction furnace introduced in U. S. steel casting industry.
1916—Automatic railroad car couplers standardized.
1918—First cast steel anchor chain poured.
1921—First molybdenum rolls cast.
1940—Metallurgical Advisory Committee on Cast Armor organized by Army Ordnance.
1943—Peak year in steel casting production in U. S.—2,743,000 tons.
1961—Centennial year of U. S. steel castings industry—approximately 240 commercial steel foundries in the United States, with 50,000 employees and an annual capacity of 2½ million tons.

SFSA Calendar of Events for the Centennial Year . . .

In addition to the Newcomen Address by Mr. Moriarty reproduced here, the Steel Founders' Society of America will observe the centennial of the steel castings industry at its annual meeting and with a Centennial Product Development Contest.

At the annual meeting, March 11-14 at the Drake Hotel, Chicago, several sessions will be devoted to the "next 100 years of progress in the steel castings industry." The product development contest, which opened last fall, closes June 1. It is open to students and employees in customer industries, and prizes totaling $10,000 will be awarded. An awards dinner will be held to honor winners.

Other events for 1961 include the society's fall meeting, at the Homestead, Hot Springs, Va., Sept. 24-26, and its technical and operating conference, Nov. 13-15 at the Hotel Carter, Cleveland.

into a whirling centrifugal mold and dropped in a quantity of powdered ferromanganese during the first part of the pouring. As the mold revolved, alloyed metal was forced to the rim, hardening the tread of the railroad wheel, but leaving the center tough and machinable.

The Standard Steel Castings Co., which had tried in the late 80s to cast an 11,000-lb gun, made an important contribution to the railroad industry in 1893. It cast a number of steel rear frames for Rock Island Railroad switch engines and a complete frame for a Baldwin locomotive. By the 1920s, these frames had become a major steel foundry product, measuring as long as 34 ft and weighing up to 140,000 lb.

Great as the expanded use of steel castings was in the railroad field, other uses were being found in increasing numbers. One of the exhibits at the Chicago Columbian Exposition of 1893 was a mining dredge featuring buckets with cast steel backs and links poured as a single steel casting. And in 1898, cast steel shells were used in the Spanish-American War.

The battleship *Alabama,* built in 1898, was fitted with a 24,623-lb cast steel stern post, and the U. S. battleship *Wisconsin,* built the same year, used an 11,480-lb steel shaft tube. Crankshafts for the United States fleet, propeller wheels 10 ft in diam, rudder frames for torpedo boats, and anchors were important cast steel items at the turn of the century.

85 Firms by 1900—By 1900, less than 40 years after its founding, the industry had grown to 85 firms and was producing 177,156 tons of steel castings annually. In the 15 years since the mid-80s, giant strides had been made.

So it was that in 1902 the Steel Founders' Society of America was organized by 17 members meeting as a luncheon club in New York. The society had its origin in the instinct of self-preservation, mutual advancement, and the common good. Founded on simple lines, it is helpful to its membership and is consulted alike by those in the industry, by the users of steel castings, and by government agencies. We are proud of the painstaking and intelligent effort of the Steel Founders' Society to live in the spirit of its motto: "Integrity . . . Research . . . Progress."

The 20th century was a new era for the industry. It was evident that America had a fully developed and prospering industry that could furnish steel shaped to final form, strong enough to carry the loads, stand the impacts, and support the sinews of a vigorous, expanding nation.

New equipment to do the job came in the form of the Tropenas-type converter, which was used extensively in the early part of the century. A French engineer, Alexander Tropenas, introduced his side-blown converter furnace to America.

In 1911, the first electric arc furnace steel for commercial castings was poured at Treadwell Engineering Co., Easton, Pa. National Malleable and Steel Castings Co. had poured the first steel made by electric arc furnace in an experimental 300-lb capacity furnace at its Sharon, Pa., plant as early as July, 1910.

The electric furnace, vastly improved since those early days, at first was used mostly for small castings. Now, approximately two-thirds of the steel used for steel castings is melted by electric furnaces. The open-hearth furnace is used most often to pour huge castings requiring great quantities of liquid steel.

The electric arc furnace was supplemented by low frequency electric induction furnaces for special types of steel in 1913. At Lebanon Steel Foundry, Lebanon, Pa., the first heat was poured from a high frequency electric furnace in 1930.

20th Century Expansion — The markets for steel castings which had been developed before 1900 were greatly expanded during the 20th century. In the railroad industry, for instance, Congress made it mandatory that all railway cars be equipped with automatic couplers after January 1, 1898. A large number of coupler designs were in use, and it finally became necessary to standardize on one design in 1916 so that parts would be interchangeable. A more modern design replaced this 1916 standard in 1931, and since then refinements have been made on both freight and passenger car couplers.

Steel foundries have worked diligently with carbuilders to design and develop safer, stronger couplers. A modern cast steel coupler will withstand a pull of over 500,000 lb, compared with 150,000 lb required by early couplers. More than 4 million cast steel couplers are in use today in the United States.

Many other parts of cars and locomotives—such as fabricated side frames—have been converted to integral cast steel construction. Today, between 16 and 18 per cent of the weight of a modern freight car is comprised of steel castings.

As more and more demands were made on steel castings, new methods of testing and quality control became necessary. Starting in the early part of the century and continuing to the present, steel foundries have used every applicable method of testing as it has been developed.

X-ray, of course, is used extensively. Magnetic particle testing, fluorescent penetrant inspection, ultrasonic testing, and various pressure testing methods are used to determine the quality of steel castings, assuring that they will meet the most stringent demands of customer industries. Many steel foundries have excellent research centers working constantly to improve their product, ex-

pand its application, and devise new and more efficient methods of manufacture.

In addition to the railroads, other markets opened to the steel casting industry. The shipbuilding industry needed not only more and better castings, but bigger castings, and as early as 1904 a 75,800-lb cast steel shaft bearing was produced for an International Steam Ship Co. liner.

The superbattleship *Arizona*, which slipped beneath the waves at Pearl Harbor, was outfitted with steel castings when it was built in 1915. And the battleship *Pennsylvania*, built the same year and severely damaged in the Pearl Harbor attack, was held together by steel castings long enough for it to be repaired and returned to service. In fact, some 343 gross tons of steel castings were used in each battleship of the Arizona class.

Steel Castings for Defense — As much as Americans abhor the thoughts of war, we know that much depends on the swiftness with which a nation can convert to wartime needs. Few industries can match the steel casting industry in flexibility. We have in the past—and we can yet today—convert to wartime products almost overnight. During the First World War, the industry poured wheels for Army trucks, gun carriages and mounts, axle brackets for gun caissons, and components for tanks.

National Malleable and Steel Castings Co. made an important discovery in 1918. With the nation at war, chain could not be made fast enough to supply the needs of a Navy, and the riddle of making chain cable as steel castings was solved by National Malleable. Thus the steel casting industry entered—and is still active—in a market the forgers had had since time immemorial.

In peace, war, and the uneasy times in between—such as we live in today—steel castings have served this Nation well. They were employed in the early tanks and ordnance equipment of the World War I, and in World War II, the guns and ships and planes and tanks all used steel castings. In fact, the steel casting industry led in the development of cast steel hulls and turrets for the big tanks of World War II. Today, the Cast Armor Committee of the Steel Founders' Society still is functioning, still developing new specifications that make today's armor vastly superior to that of 20 years ago. Both the hull and turret of America's newest tank, the 51-ton M-60, are one-piece castings.

F. Kermit Donaldson, left, executive vice president, Steel Founders' Society of America, and the author examine an exhibit at the Franklin Institute prior to Mr. Moriarty's Newcomen Address

Pump Castings—Within the last 25 years, nearly all high-pressure pumps have used cast steel components. In the Southwest, five pumping stations lift a billion gallons of water a day from the Colorado River and push it 654 miles to supply water to Los Angeles County.

At the Nation's biggest dam, the Grand Coulee, which backs up the Columbia River, a 30-ton cast steel impeller wheel is used in each of the 12 pumps needed to move water from man-made Lake Roosevelt to the Grand Coulee Reservoir 270 ft above the lake's water level.

Steel castings have been used in earth moving equipment since steam first replaced horses as a power source. They were part of the power shovels that chewed for more than 10 years to dig the Panama Canal, and today they are an integral part of the huge shovels used in strip mining, monsters so large that five of them could have dug the Panama Canal in 10 short months.

Steel castings ranging from 50 to 19,000 lbs, capable of withstanding pressures up to 2500 psi and temperatures of about 575° F are used in the hermetically sealed scanned motor pumps in the pressurized water reactor systems of nuclear ships and power plants. Steel castings have found their place in the construction of our nuclear powered fleet, and several tons of steel castings were used in the first nuclear powered passenger-cargo ship, the *N. S. Savannah*.

From meager and uncertain beginning, the steel castings industry has grown to one of nearly 2½ million net tons of annual capacity, with some 240 commercial steel foundries providing employment for more than 50,000 persons. Its past pledges steel founders to a future of serving industry—great and small—for another 100 years.

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QUESTIONS and ANSWERS

- **Alloying copper with other elements requires application of skill and experience**
- **Application of chilling and insulation at the mold-metal interface controls the cooling rate**
- **Gas-creating materials on parts to be covered with molten metal result in porosity in the casting**
- **Differences in cooling rates between various parts of the casting cause warping**

Making Copper-base Alloys

My foundry operation is quite small and up to the present I never had need for any alloys since that was met by melting scrap bushings. However, now I would like to obtain information on how to mix copper, lead, zinc, and tin so that I can produce other types of castings as well as bushings.

You will be much better off to buy composition ingots than to try to make the desired alloy by melting copper and adding the requisite amounts of lead, tin, zinc, etc. With composition ingot, all that is necessary is to select the proper weight of the desired composition, melt it down and pour it into the molds.

Making your own alloys is somewhat complicated. You will require an inventory of copper, lead, tin, and zinc of known commercial purity. Those materials will have to be weighed out reasonably accurately, and it is preferable to have two scales—one for weighing the large amounts of copper and a smaller one for the tin, lead, and zinc which are used in lesser amounts.

Since the latter metals have much lower melting points than the copper, they usually are added just a short time before the mixture is ready to be poured into castings. Procedure is to melt the copper as rapidly as possible and degasify it if necessary. Then the temperature is increased somewhat above the desired pouring temperature of the final alloy. The increase will depend on the amount of cold metals to be added.

About five minutes before the crucible is to be drawn from the furnace, the additions of tin, lead and zinc are made, and after they have dissolved the bath is stirred with a curved graphite rod with a gentle up and down pumping motion. Metal temperature is checked and, if satisfactory, the crucible is withdrawn, carefully skimmed and poured.

Serpentine Is a Mineral

Some time ago we saw in the literature a reference to serpentine being tried as a molding medium, but we have not been able to locate any information on what it is. Can you supply any data?

Geologically, the term "serpentine" is applied to a group of minerals of the general composition H_4 (Mg·Fe) Si_2O_9, probably crystallizing in the rhombic system. Varieties are known under different names according to habit and optical properties. The fibrous types include chrysotile, metaxite and picrolite, and a platey variety known as antigorite. Hardness ranges from 3 to 4 Moh, and the density from 2.5 to 2.7. Color usually is green but is dependent on the iron content. Colorless, red, and yellow serpentines are known.

Serpentine is a common alteration product of $MgSiO_3$, particularly of olivine and rhombic and monoclinic pyroxenes. Asbestos of commerce is largely chrysotile and is derived from both igneous rocks and metamorphosed dolomite. Some varieties of serpentine are used for exterior and interior building stone, one type being known as "verde antique." Quarrying of such stone is conducted in California, Georgia, Maryland, Massachusetts, Vermont, Washington, and Wyoming.

Producing Zinc Alloy Dies

We use zinc-base dies weighing 400 to 10,000 lb for prototype work on automobile bodies, and are trying to obtain dimensional tolerances within 0.060 in. in length. Through improvement in accuracy of the patterns we are getting better control of shrinkage, but still are getting some warpage. This may or may not be the fault of the foundry equipment. Do you know of any corrective measures which might be applied?

Warpage in these large zinc-base dies is due to differential cooling rates in the mold, and, according to an investigation of the problem some years ago, it can be minimized if not eliminated by establishing controlled solidification of the castings. That is accomplished through application of chilling, and of insulation, or both. It is said that dies under 18 in. square do not require either chilling or insulation, and square dies over those dimensions need only chilling. Long narrow

dies require both chilling and insulation.

Chilling, of course, is applied to the working face of the die, and is accomplished through use of a special facing sand in which flexible, unbraided (bare), bronze steam hose is imbedded. Insulation, applied to the ends and sides, is in the form of high-temperature insulating board ¾ or 1 in. thick. With a long narrow die the procedure is to set the pattern face up on a large flat board. The board size will accommodate the flask to be used for producing the sand mold.

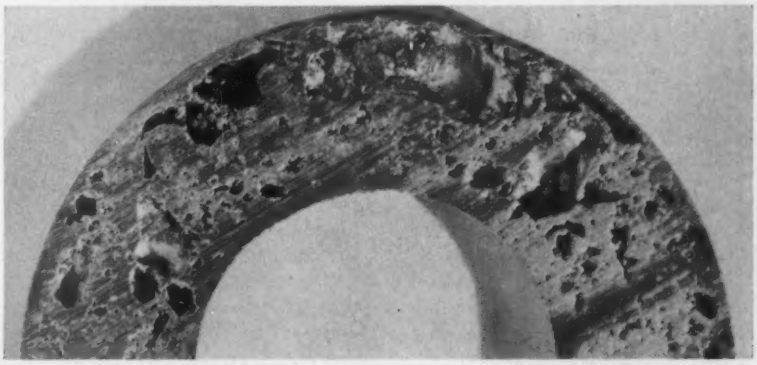
The insulating board, wide enough to extend 4 or 5 in. above the top of the pattern, is placed along the sides and ends. Then a flask large enough to permit about a foot of sand all around the exterior of the enclosed pattern is placed in position. Height of the flask should allow about a foot of sand over the pattern. References to sand are relative and will vary according to the size of the die. In this instance they apply to a die about 36 x 18 in. Backing sand is rammed tightly in place around the insulating board and pattern to a depth of a few inches above the top of the pattern.

The pattern is covered with a layer of the special facing sand about 1½ in. deep by riddling, and rammed hard to a thickness of about ½ in. The facing sand is composed of three parts by weight of Albany No. 00 sand and one part by weight of 30 mesh commercial graphite. Ingredients are mulled together for about 4 minutes, water is added slowly and then the mix is mulled for an additional 4 minutes. Due to the fines introduced by the graphite, the moisture content is somewhat greater than for the Albany sand.

After the facing sand is rammed in place the flexible bronze hose is laid on in parallel rows 2 or 3 in. apart and held securely in place by weights. The hose, in one piece, is looped at the ends of the rows, and sharp bends must be avoided. The hose is covered with a layer of the facing sand to hold it securely in place, removing the weights as the ramming progresses. Then the remainder of the flask is filled with backing sand which is rammed into place.

Sand is struck off, the bottom board clamped in position, and the assembly rolled over. The pattern is withdrawn. Shortly before pouring is begun, water is turned on so that it flows at a rate rapid enough to prevent steam formation during and after pouring.

Nothing has been mentioned about gating. Generally a sprue about 1¼ in. in diam is placed about 3½ in. from the cavity. It may be made by ramming sprue stick into place, but some prefer a brass tube. Gate into the casting cavity is the same size, and enters just above the bottom of the mold cavity.



Ring section of electric motor rotor shows numerous and large holes

Diecast Rotor Contains Holes

We are forwarding for your consideration a rotor for a small electric motor with aluminum end rings and bars which are integrated with the steel laminations by diecasting. You will note that the aluminum portion (7¾ in. OD, 4 in. ID, and ½ in. thick) is full of holes.

The aluminum used is A-100 (0.6 Fe) which is taken from the furnace at about 1400° F, and probably is 1300° when poured, due to transfer to the diecasting machine. The porous section is toward the back of the machine. We have had this trouble off and on for some time, and cannot figure out the cause.

We believe that the cause of the holes is lack of cleanliness in the laminations. Examination of the laminations shows that they are covered with oil, and when the molten aluminum comes in contact with the oily surfaces, gases are created. These gases enter the aluminum and cause the holes.

Naturally, the greater the amount of oil present and the higher the temperature of the molten metal, the greater the volume of gases created with increased number and size of the holes. Perhaps the metal may pick up some gas during melting; but that would not result in the condition shown.

Your problem can be overcome by complete removal of oil from the laminations. They also should be free from moisture which will create steam and cause porosity in the aluminum. To insure against presence of moisture, store the stacks of laminations in an oven close to the diecasting machine. Oven temperature should be maintained around 220° F —a few degrees above the boiling point of water.

Pump Castings Tend To Warp

In our foundry in Colombia we are experiencing serious problems with warpage of our cast iron pieces. We are making pump castings and similar materials with thicknesses of ¼ to ½ in. We are aware that to avoid warpage, stress relieving is required, and would appreciate your advice on the most practical method.

We would like a fast method which does not require too much capital investment. We are thinking of installing a small heat treating furnace for the purpose.

Warpage indicates that strains are present which may be due to wide differences in solidification rates in various parts of the castings. Often these differences can be minimized by changes in the gating system which will result in progressive or directional solidification. Study your present gating method to see whether changes will produce the desired results.

Residual strains in a casting also can result from faulty design of the

cast part. Designs employing ample fillets and general streamlining of the part generally will produce parts with minimum strain.

Casting warpage after machining operations can be minimized by a stress relief heat treatment prior to machining. It involves heating the castings to around 1000° F and holding at the temperature until they are heated throughout. Then they are allowed to cool slowly in the furnace.

Holding time at temperature usually is one hour per inch thickness of the heaviest section. For your castings with ½-in. sections, holding for ½ hour should suffice although it may be advisable to begin by holding for one hour.

Molds for Glass Must Withstand Drastic Temperature Changes

We produce cast iron molds for the glass industry, and from time to time run into the problem of fire cracking or heat checking caused by the periodic heating and cooling of the mold surface during the manufacture of glassware. The temperature may range from 850 or 900° F to 1250° F in an operating cycle of 12 to 14 seconds. Is there any technical information available, and would addition of alloys aid in overcoming the problem?

Glass molds, as you indicate, have to withstand severe service conditions, and accordingly must possess a wide variety of properties to provide the best over-all life. Properties include good machinability, fine dense surface to produce a good surface finish on the glass, resistance to growth and distortion, good heat, scaling and cracking resistance at high temperature, etc.

Bruckner and Czyzewski in *Transactions*, AFS, 1942, pointed out that the structure of the mold has an important effect on its life, and best results were obtained with an alloy iron which was annealed to provide a matrix of free ferrite, partially spheroidized pearlite, and lamellar pearlite.

The authors said that the ferrite absorbed the thermal shock, and the lamellar pearlite provided strength to resist the spread of cracks. The alloy iron which under the test conditions gave the best results contained 2.40 per cent Si, 0.66 per cent Mn, 3.44 per cent TC, 1.25 per cent Ni, 0.45 per cent Cr, and 0.50 per cent Mo. Specimens were cast in the form of 6 x 9 x 2½ in. blocks, with the 6 x 9-in. face cast against a chill. From those blocks, 2-in. diam, 2-in. long specimens were turned and then annealed by heating slowly to 1400° F, held for 4 hours, and furnace cooled.

Sand-cast alloy irons under the test conditions gave better results than chill-cast materials, but the coarse graphite flakes resulted in an open, porous structure which did not take the requisite polish demanded for glassware production. Indications also were that irons which produced a dendritic structure were less resistant to cracking —the more dendritic, the less resistant.

In the discussion of the paper it was indicated that high-total-carbon irons are more resistant to thermal shock than low-carbon irons, that chill-cast irons invariably develop a dendritic structure, and that while high-carbon irons usually are not affected greatly by inoculation, that practice with such irons cast against a chill should be beneficial and result in improving the structure.

In the February, 1958, issue of *B.C.I.R.A. Journal*, an article by R. Barton on "Cast Iron for Glass Molds" states that it seems probable that a straight unalloyed iron with a composition of the order of total carbon 3.4 to 3.6 per cent, silicon 1.8 to 2.2 per cent, sulfur 0.12 per cent, manganese 0.45 to 0.8 per cent, and phosphorus 0.4 per cent has served the general purposes of the glass industry as satisfactorily as the more elaborate irons. The mold faces should be chill cast to prevent flakes of kish graphite from reaching the working surface which gives rapid breakdown to penetrating oxidation.

The author suggests also that nodular iron might be a possibility since it possesses good thermal shock resistance which should reduce the possibility of cracking and heat checking. It also has good resistance to oxidation, machines well, and produces a good surface finish. Main disadvantage is that its thermal conductivity is lower than flake graphite irons, and molds would tend to run hotter. Determination of whether or not the material will be suitable can be ascertained only by field testing.

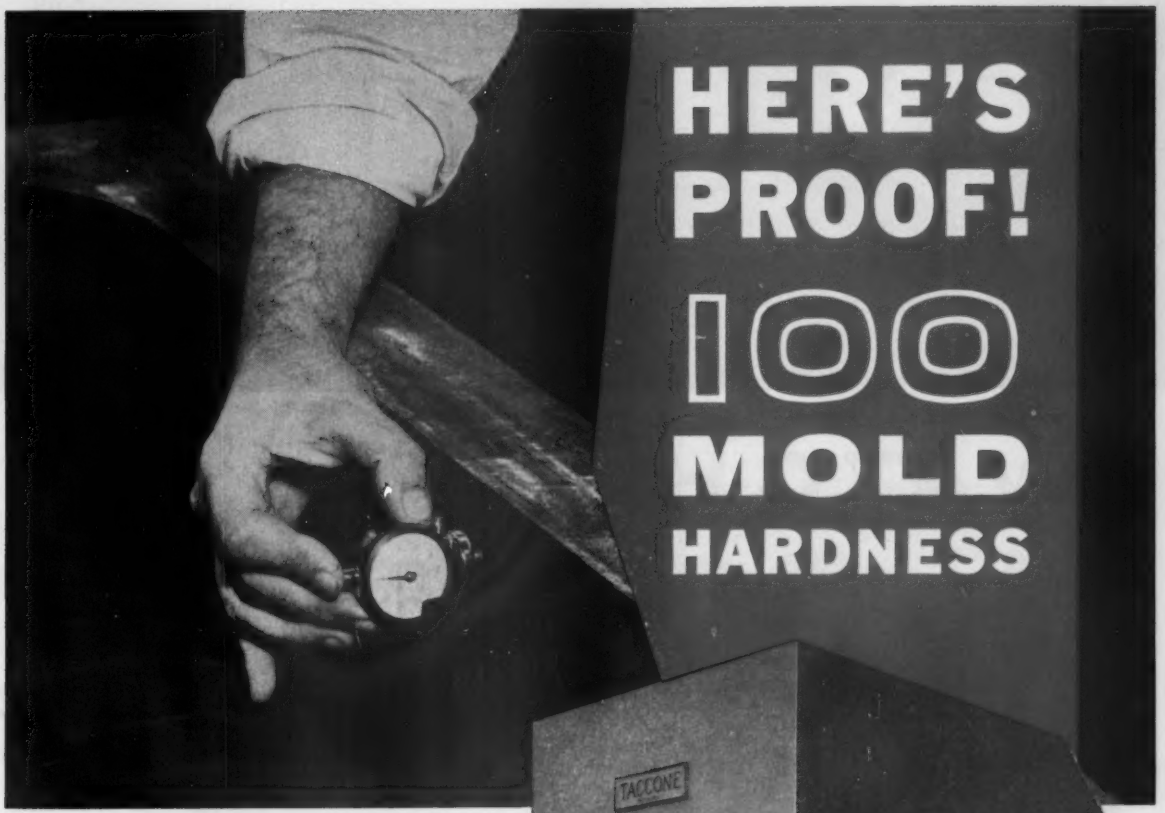
Hard Spots on Cope Side Cause Trouble in Gray Iron Casting

We are forwarding for your attention two small gray iron castings having small hard spots on the cope sides. One of the castings has been heat treated. Both have been machined. We have poured many tons of castings, but never had a complaint of this same nature. We are inclined to believe that this is caused by some foreign material which got into our cupola mix.

Base iron for these castings contained 2.25 per cent silicon and 3.50 per cent carbon. Since the castings must be easily machinable and the customer calls for a nickel addition, we use 0.25 "F" nickel shot and put it in the hand ladle. We use 10 per cent steel scrap in our cupola mix.

Your suspicion that the hard spots are caused by foreign material appears to be well founded, but the source is not something entering with the cupola charges. It is something that is introduced into the molten metal just prior to pouring into the mold. That opinion is based on the consideration that if it were something in the metal over the spout, it would tend to be distributed throughout the metal, and hence appear on other surface areas as well as on the cope side, not to mention in the interior.

The hard spots appear to be bright, lens-like formations, but we do not have the means to determine just what they are, and only can offer some conjectures. You mention that the nickel shot is added to the hand ladle, and presumably to insure solution of the nickel, the molten metal is stirred well with an iron or steel rod. It may be that scale on the rod is washed off into the metal and carried into the mold cavity. Being lighter than the metal it floats on the top of the stream, and comes to rest on the upper surface of the mold cavity where it is surrounded by the iron.

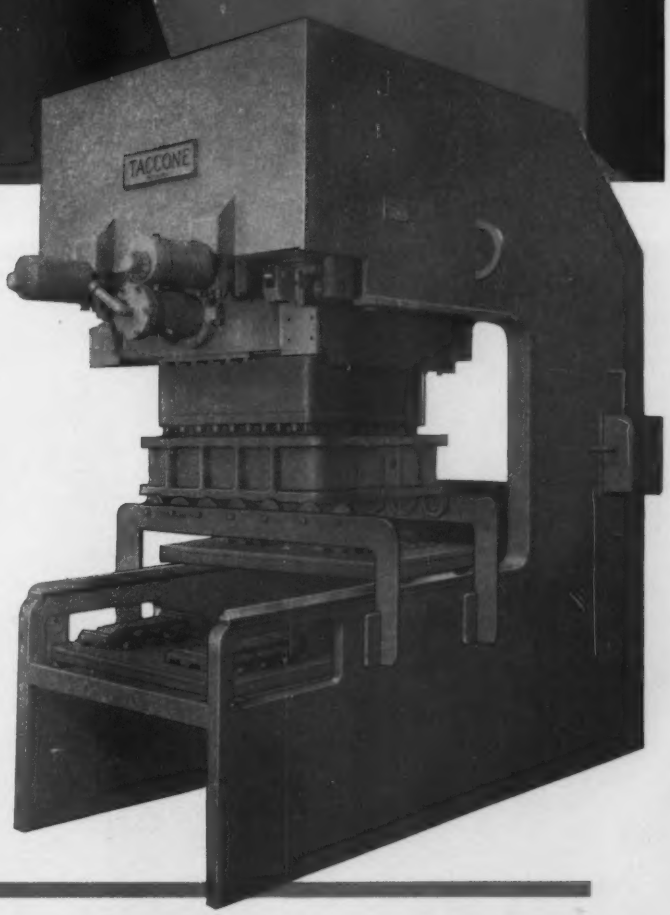


HERE'S PROOF!

100 MOLD HARDNESS

The TACCONE HYDRA-PNEUMATIC MOLDING MACHINE has solved the problems of uniform high density molding with green sand using an extremely wide range of sand mixes—green mold hardness of 100 if desired. Uniform density over entire mold surface right up to the flask edges. No soft spots—the TACCONE Hydra-Pneumatic Principle tends to make the sand act as a fluid by transmitting equal pressure in all directions. Opens the field for high production precision green sand molds for thin wall ferrous castings, as well as non-ferrous castings. Allows the ferrous green sand casting business to gain more prominence in the cast metal industry.

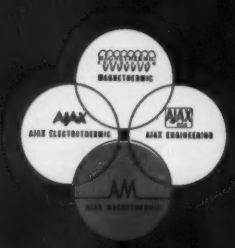
Demonstrations invited.



TACCONE Hydra-Pneumatic Mold Machine with Pattern Shuttle Equipment.

TACCONE
CORPORATION
NORTH EAST • PA.

Circle 608 on Page 39



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HEATING AND MELTING BY INDUCTION...

WATCH AM

Core-type melting furnace, one of many products of AM, for the heating or melting of metals by induction.

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New EQUIPMENT and SUPPLIES

For More Information, Use Reader Service Card—Page 39

CONTINUOUS CLAY WASHER

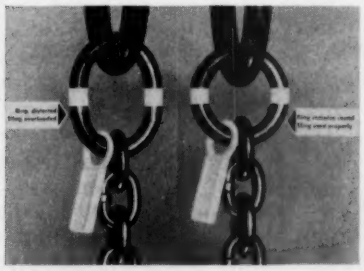
Clay washer, No. 522, is designed to determine AFS clay. Unit operates on the elutriation principle, employing a vertically moving flow of water to remove particles finer

than twenty microns. Sand is scrubbed continuously by a water jet from a motor-driven agitator tube so that the clay is carried out at the top of the vessel by the water flow. Unit is said to effect considerable savings in operator time.—**Harry W. Dietert Co.**, 9330 Roselawn, Detroit 4, Mich.

For More Details Circle No. 451—Page 39

SLING CHAIN SAFETY LINK

Sling chain is provided with warning ring which elongates when the sling is overloaded. Though stronger

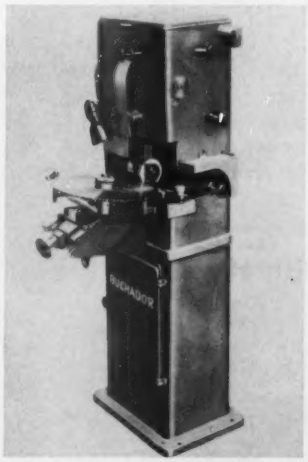


than the chain itself, the ring gives immediate warning of overloading by elongating before permanent damage can occur to the sling. Ring can be replaced easily at the factory. All types of sling chains with the warning ring are available.—**Campbell Chain Co.**, York, Pa.

For More Details Circle No. 452—Page 39

SAW BLADE GRINDER

Machine automatically grinds circular metal-cutting saw blades. Attachments are available to adapt unit to grinding power hacksaw blades, bandsaw blades, and straight-edged knives. A 6-in. grinding wheel moves forward, cutting the face of the tooth while the saw blade remains stationary. Back of the tooth is cut as the wheel moves back and the blade is fed forward by a feed pawl. Unit is capable of cutting circular saw blades 2 to 16 in. in diam and bandsaw blades



from 3/16 to 2⅜ in. wide. Cutting speeds are 50 and 80 teeth per minute.—**Cosmic Inc.**, 1028 Connecticut Ave. N. W., Washington 6, D. C.

For More Details Circle No. 453—Page 39

ZINC DIECASTING ALLOY

Diecasting alloy, Apex No. 7, is a high-purity zinc alloy composition which parallels those of other No. 7 alloys. Quantometer analyses are used to maintain the necessary magnesium and nickel content in low, but controlled, quantities. Also available is Apex-98DCZ, a special high purity aluminum hardener used to process the new alloy.—**Apex Smelting Co.**, 2537 W. Taylor St., Chicago 12, Ill.

For More Details Circle No. 454—Page 39

DUST RESPIRATOR

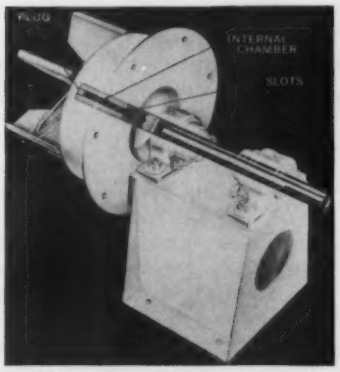
Dust respirator is all plastic and utilizes a washable foam filter element. Outer frame, with polyeth-

ylene cushion, is made in one size to fit all faces. Inner frame locks the filter into place. Unit is said to be nontoxic and nonallergenic.—**Glendale Optical Co.**, Valley Stream, N. Y.

For More Details Circle No. 455—Page 39

HIGH-TEMPERATURE FANS

High-temperature fans for ovens, kilns, furnaces and dryers operating at temperatures up to 1700° F come equipped with air-cooled shafts which eliminate need for water cooling, heat slingers, and other cool-



ing devices. Made of nickel chromium stainless steel, each shaft has an integral chamber and slot arrangement which is said to reduce

←Circle 609 on Page 39

transmission of heat. As the shaft rotates, air is evacuated from the internal chamber through four slotted orifices, creating a heat transfer barrier which keeps shaft cool at all vital bearing points.—**Garden City Fan & Blower Co.**, 801 N. Eighth St., Niles, Mich.

Add Cut, Must Go March

For More Details Circle No. 456—Page 39

MATERIALS SPRAY GUN

Spray gun can be used to spray plastic, plaster, or polysulfide rubber. Viscosity of materials sprayed can vary from 10 to 18,000 centipoises. Air pressure requirements are 40 to 60 psi for laminating resins and 60 to 90 psi for plaster and rubber. An air control knob can be adjusted to provide proper pressure. For low viscosity resins, output capacity is 1 to 2 lb per minute; for high viscosity resins it is ½ to 1 lb per minute; and for plaster it is 2 to 4 lb per minute. —**United States Gypsum Co.**, 300 W. Adams St., Chicago 6, Ill.

For More Details Circle No. 457—Page 39

WORK GLOVES

Plastic-impregnated gloves said to be snag resistant and long wearing can be used for any work glove

application. Although gloves are not moisture or oil-repellant, they show less absorption than untreated cloth gloves. These gloves have no inside seams and are available in three sizes.—**Jomac Inc.**, Philadelphia 38, Pa.

For More Details Circle No. 458—Page 39

DIECASTING MACHINE

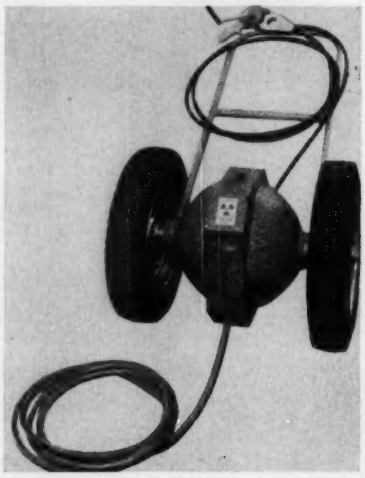
Automatic diecasting machine, Model 400, provides 400-ton clamping pressure and incorporates several design changes. It has 40½ by 40-in. die plates with 20 by 24-in. space between tie bars. Unit will accommodate dies between 12 and 32 in. thick, with an adjustable die opening ranging from 6 to 12 in. Movable platen is supported by rollers to relieve the tie bars of the weight of platen and die.

Both hydraulic and electrical systems are designed to JIC standards. Cold chamber end employs a shot cylinder 4 in. in diam with stroke adjustable from 14 to 18 in. Hot chamber end includes a cast steel shot cylinder 4 in. in diam with a 7-in. stroke. Machine's operating sequences are programmed by templates.—**Cleveland Automatic Machine Co.**, 4932 Beech St., Cincinnati 12, Ohio.

For More Details Circle No. 459—Page 39

COBALT RADIOGRAPHY UNIT

Cobalt 60 radiography cameras are designed for panoramic and internal radiography where the machine positions the source. Capacities are 1, 5, 10, 30, and 100 curies of cobalt 60, and weights range



from 190 to 1100 lb. Units are mounted on pneumatic tires and are provided with handles for convenient movement about the shop. Provisions can be made on all units for containing and using more than one radioactive source.—**Radionics Inc.**, Lafayette & Water Streets, Norristown, Pa.

For More Details Circle No. 460—Page 39

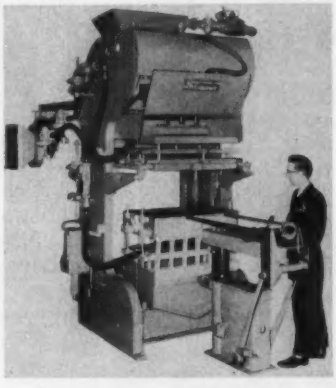
MOTION SAFETY SWITCH

Motion safety switch protects machines and processes against damage due to failure of one machine serving another. When the first machine fails, the switch either shuts down subsequent operations before they become jammed or operates a warning device. Switch is 9¼ in. high and 9½ in. wide and can be driven in either direction at 40 or 100 rpm. A sprocket on the switch's drive shaft is driven by the first machine through a chain drive. Bevel gears transmit this drive to a hori-

Coreblower Is For Use With Hot Box Process

Coreblower, Model CB-25-GF, is designed for use with all furfuryl alcohol type binders used in the hot box process. Production of cores ranges up to 140 per hour when a 15-second cure time is used. Output can be increased if cure time is reduced or if multiple cavity boxes are used.

Illustration shows the pickoff unit which delivers the finished cores to the operator. Advantages claimed for the unit include low initial cost, low gas consumption, small floor space requirements, and little maintenance due to few moving parts. Other features of the unit are thermostatic temperature control of both halves of the corebox; automatic sequence control of blow, cure, and strip; and dual



machine operation so that one man can operate two machines.—**Beardsley & Piper Div., Pettibone-Mulliken Corp.**, 2424 N. Cicero Ave., Chicago 39, Ill.

For More Details Circle No. 484—Page 39

Bigger savings, based on better solutions to your problems...these are WHEELABRATOR'S

VITAL VALUES FOR INDUSTRY

What are the Vital Values you want in the equipment you buy? If it's Vital Quality that keeps the machine operating long after others have failed, try Wheelabrator. If it's Inventiveness that solves your problem most completely and profitably, try Wheelabrator. If it's Vital Service that helps you get the most out of your equipment and people, try Wheelabrator. Wheelabrator puts the "Vital Values" in its Blast Cleaning and Dust and Fume Control equipment that mean bigger savings and better performance for you. Ask for the Wheelabrator story.

VITAL VALUES FOR INDUSTRY

WHEELABRATOR

airless blast cleaning—steel abrasives—dust and fume control

WHEELABRATOR CORPORATION, 505 S. Byrkit St., Mishawaka, Indiana, In Canada, WHEELABRATOR CORPORATION OF CANADA, LTD. 1901 Birchmount Rd. P.O. Box 490, Scarborough, Ontario
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zontal paddle wheel revolving in a body of oil. Movement of the liquid tilts a vane supported by a shaft, which has a cam on its opposite end. Whenever agitation of the oil by the paddle wheel stops, the vane becomes vertical. This action causes the cam to operate a microswitch, either to open or close a circuit, as desired.—**Fuller Co.**, Catasauqua, Pa.

For More Details Circle No. 461—Page 39

DRUM-HANDLING ATTACHMENT

Attachment is used to handle drums with fork lifts without danger of dropping or piercing a drum. Lift truck operator drops unit over drum, tightens a clamp, and picks up the drum on his fork. As shown in photo, little effort is required to tilt drum for pouring or other use.

Unit weighs 11¾ lb, but has a load limit of 1000 lb. Stainless steel models are available for use with corrosive liquids.—**Holsclaw Bros. Inc.**, 408 N. Willow Rd., Evansville, Ind.

For More Details Circle No. 462—Page 39

PORTABLE X-RAY UNIT

Portable x-ray unit is said to be able to penetrate steel up to 1⅞ in. thick. Two models weighing 50 lb each, are available. Model 150-P features a 360-degree x-ray tube for circumferential radiography. It is adaptable to directional use when an adjustable diaphragm is used. Model 150-D features a wide angle, 60-degree tube. Both versions are convertible, one to the other, at any time. Units are 10 in. in diam by 25 in. long. Power supply of 115 or 230 v, 50 or 60 cycles, single phase, is used to produce a power rating of 150 kv-3 ma.—**Balteau Electric Corp.**, 5 New St., Stamford, Conn.

For More Details Circle No. 463—Page 39

AUTOMATIC POSITIONER

Automatic positioner is an electrical-mechanical device which can position machine tools, valves, doors,

and hopper gates in any one of several predetermined positions corresponding to a control selector switch. Unit can be used with various power mechanisms such as air or hydraulic cylinders. Limit switches are used to shut off hydraulic fluid or air when a desired position is reached. As many as 14 sets of switches per foot can be used. Positioning accuracy of plus or minus 0.005 in. can be achieved, depending on application.—**Hanna Engineering Works**, 1765 Elston Ave., Chicago 22, Ill.

For More Details Circle No. 464—Page 39

PARTING AGENT

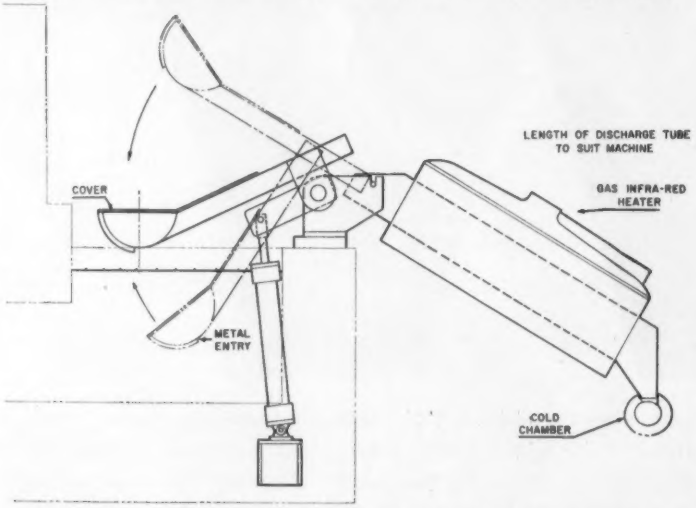
Parting agent is used to part urea cores made in dielectric ovens from the coreboxes. It withstands high temperatures. Material is sprayed on from its aerosol spray container and is said not to cause buildup on coreboxes. — **Allaco Products**, 238 Main St., Cambridge, Mass.

For More Details Circle No. 465—Page 39

GRINDING DISCS

Grinding discs are manufactured by methods claimed to insure uniformity in one disc to another. Designated B14, discs are made of aluminum oxide or silicon carbide abrasives with a resinoid bond and can be used on every type of disc sander. Materials that can be ground include steels, gray iron, and non-

Automatic Ladle Delivers 300 Shots Per Hour



Automatic ladle for die or permanent mold casting features a discharge tube which is heated by a gas-fired infrared unit to prevent temperature loss. Oxide inclusions and hydrogen absorption are minimized by bottom filling and covered passages. All surfaces in contact with the metal are coated with a nonwetting ceramic. A complete electrical control system integrates ladle operation with the casting machine, and a safety cancel feature automatically prevents metal pour if the dies do not lock up.

Ladle is operated hydraulically from the casting machine's hydraulic system, at rates up to 300 shots per hour. Ladles varying from 1 to 150 lb are available. All sizes deliver within ½-oz accuracy on each shot. Ladle is said to be adaptable to practically all existing machines and furnaces.—**J. A. Kozma Co.**, 2471 Wyoming, Dearborn, Mich.

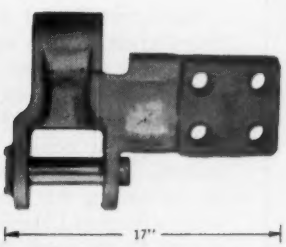
For More Details Circle No. 485—Page 39

6000 hours continuous operation without conveyor down-time

A demonstration of WHEELABRATOR'S

VITAL VALUES

A 70 cu. ft. Wheelabrator Tumblast handles loads of steel castings weighing up to 10,000 lbs. each, 16 hours a day, 6 days a week for a prominent Milwaukee steel foundry. This is one of the most severe tests of strength and durability that can be given the work conveyor of any blast cleaning machine. Yet, in 6000 operating hours, there has been absolutely no maintenance required on the rugged work conveyor of this machine. The reason—the work conveyor is just one of the many areas where the Vital Values built into every Wheelabrator keep these units operating at their peak of blast cleaning efficiency for thousands of hours—at bigger savings to you. Write today for the Super Tumblast story.



Conveyor link removed for inspection after equivalent of 3 years' single-shift operation. No perceptible wear has resulted in any area.

Heavy duty machine components take the beating of 10,000-lb. loads in stride to save operating and maintenance costs.

VITAL VALUES FOR INDUSTRY

WHEELABRATOR AIRLESS BLAST EQUIPMENT

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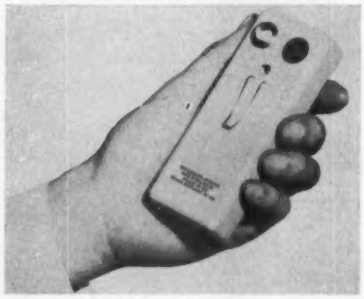
ferrous metals. Discs are available in a range of types and sizes for various applications.—**Norton Co.**, Worcester 6, Mass.

For More Details Circle No. 466—Page 39

RADIATION DETECTOR

Personal radiation detector is quick warning to prevent exposure to dangerous radiation from radioisotopes, gamma rays, or x-rays. The unit is designated the Sparrow and warns immediately of radiation as

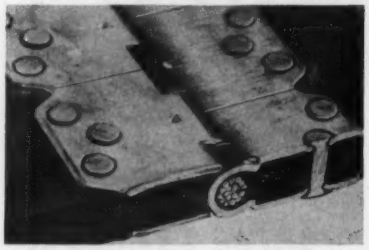


low as 3 mR per hr by emitting a violent crackle. Higher levels cause a buzz or a shrill whistle. The detector weighs 5 oz and will clip into a shirt or lab coat pocket. Penlight batteries power the unit for up to a week.—**Gelman Instrument Co.**, 106 N. Main St., Chelsea, Mich.

For More Details Circle No. 467—Page 39

CONVEYOR BELT SPLICE

Conveyor belt splice is for use on belts with interwoven carcass without drilling or hole punching. Pointed rivets are used to fasten



the splice so that the belt fabric is not cut and weakened. Illustration shows the cable pin in the hinge-type splice which can go around small-diameter pulleys easily. Construction of the hinge plate allows the splice to conform with conveyor trough curvature even when reversed. Strength of the splice is rated at up to 68 per cent of the belt tensile limit. It is available for belts from 1/32 to 1 in. thick and up to 72 in. wide.—**General Splice Corp.**, 32 Woodworth Ave., Yonkers, N. Y.

For More Details Circle No. 468—Page 39

AIR FILTER

Air filter unit employs a spongy plastic called Foamat to filter dirt and dust from air passing through it. A sheet of the material is folded in pleats in an aluminum holding frame. Filter is cleaned by spraying with a hose or, in extreme cases, by soaking in a detergent and rinsing. It is said to be resistant to moisture, vermin, and fire. It is available in three models permitting capacities as high as 1800 cfm at velocities up to 450 fpm.—**Dept. PD, American Air Filter Co.**, 215 Central Ave., Louisville 8, Ky.

For More Details Circle No. 469—Page 39

SAMPLE PULVERIZER

Pulverizer uses an air-powered spinner riveter with mortar and pestle to receive and pulverize samples. Unit is actuated by a hand lever which pounds and spins the sample on each stroke. It will pul-

verize samples for carbon, phosphorus, manganese, nickel, and chromium determinations.—**Gardner-Denver Co.**, Quincy, Ill.

For More Details Circle No. 470—Page 39

RESIN-COATED SAND

Resin-coated sand is available in round-grain type for shell cores and subangular type for shell molds. Standard melting point for the resin-coated sand is 200-250° F, and sand with different melting points can be ordered. A lubricant is incorporated in the coating for easy pattern release.—**Bennett-Ireland Inc.**, 56 Exchange St., Norwich, N. Y.

For More Details Circle No. 471—Page 39

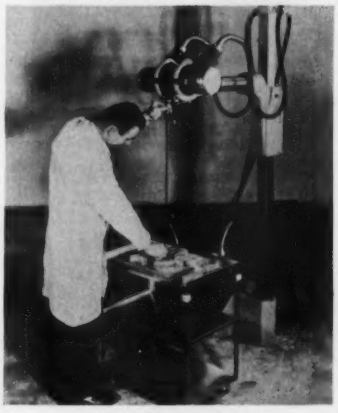
PNEUMATIC GRINDERS

Pneumatic grinders have an adjustable speed feature permitting operation at speeds between 16,000 and 25,000 rpm, depending on the work material. Operating speed is set by rotating a calibrated ring throttle speed regulator. Grinders are designed for driving small grind-

Water-Cooled X-Ray Unit Has High Capacity

Heavy-duty industrial x-ray machine is available for use in applications requiring large amounts of nondestructive inspection. Sharp pictures result from using an x-ray tube with a 0.012-in. focal spot. Unit has a rotating anode tube with a continuous rating of 6 ma at 150 kv. Controlled high radiation output is said to allow shorter exposures, and water cooling of the anode tube permits handling heavy inspection volume without danger of overheating.

A counterweighted 3-in. square mast eliminates vibration and assures clear images. Mast can be pivoted 360 degrees and fits under an 8-ft ceiling. Unit also has a telescoping tube arm, which provides 16-in. cross-travel, plus



an axis for complete rotation of the tube hanger.—**Picker X-Ray Corp.**, 25 S. Broadway, White Plains, N. Y.

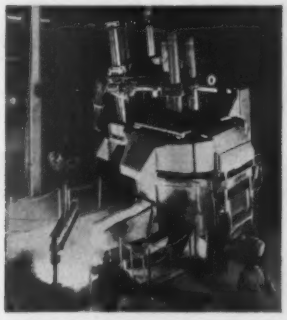
For More Details Circle No. 486—Page 39

Double savings in electric furnace fume control

A demonstration of WHEELABRATOR'S

VITAL VALUES

Hundreds of pounds of foreign matter are removed daily from the atmosphere in each of the 54 Wheelabrator electric furnace fume control systems installed in prominent steel foundries. This quantity of dust and fume is removed at a double savings as a result of the Vital Values incorporated in each system. They provide the necessary efficiencies at a savings in initial costs compared to other possible methods. They repeat the savings daily because they are so much less costly to operate. A choice of hooding methods tailored to individual furnace requirements providing complete flexibility, no visible solids in the effluent gases and rock-bottom operating and maintenance costs are some of the Vital Values you get only from Wheelabrator.



Thirty-nine prominent foundries are now ventilating 54 electric furnaces with Wheelabrator fume control systems, handling a combined total of over a million c.f.m. of air. Send for full details.

VITAL VALUES FOR INDUSTRY

WHEELABRATOR DUST AND FUME CONTROL

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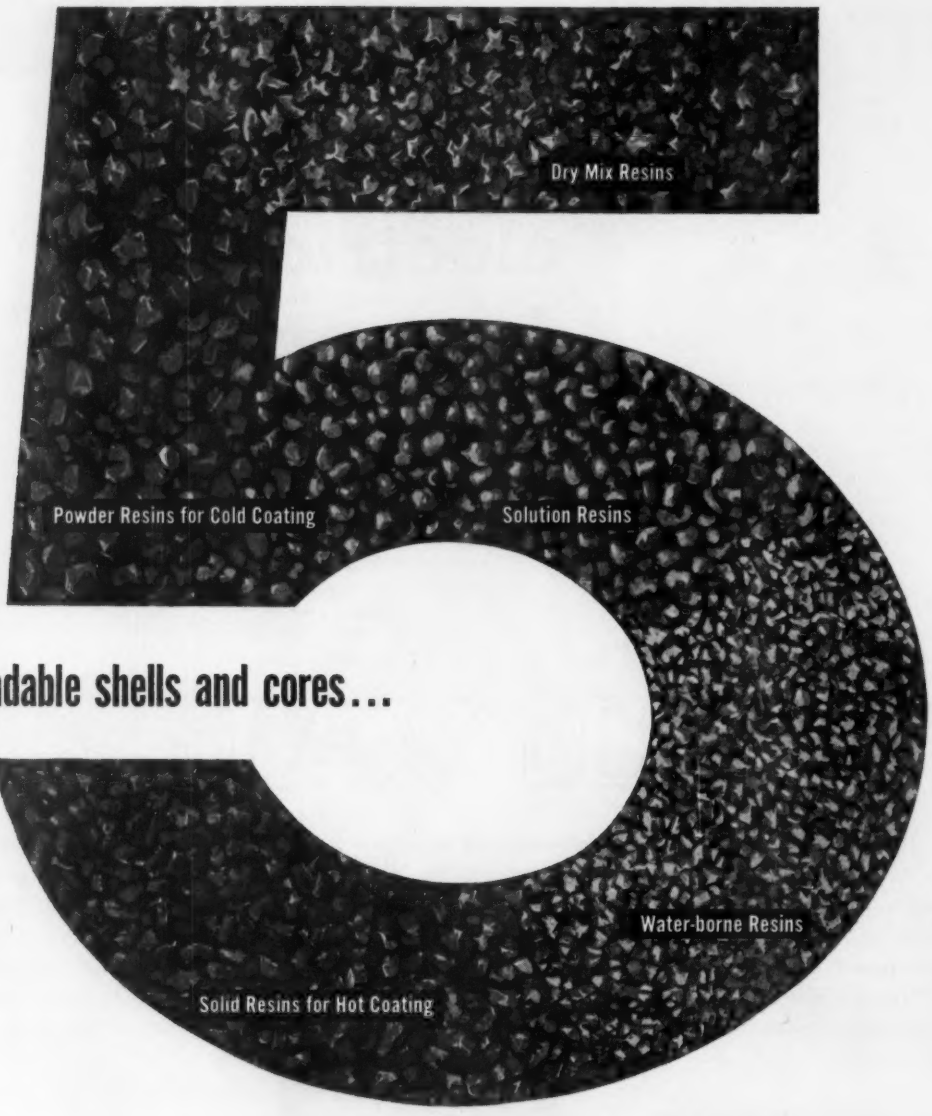


For dependable shells and cores...

5 REASONS WHY YOU SHOULD USE "BAKELITE" FOUNDRY RESINS

Now you can get five different classes of BAKELITE Phenolic Resins—each one foundry-designed for a specific class of the sand-bonding techniques used in shell and core molding.

Foundrymen throughout the country are finding that these "prescription" resins save money and time by reducing rejects, by yielding desired finishes to close tolerances, and by consistently performing with the same high degree of dependability.

Basic classes of BAKELITE Phenolic Resins for foundry operations are: 1) Powder resins for dry mix bonding, 2) Powder resins for cold coating, 3) Solution resins for cold coating, 4) Water-borne resins for warm coating, and 5) Solid resins for hot coating.

So why not take 5 minutes and give our Technical Representative a call to discuss the full story of the BIG 5 in shell and core molding resins. Contact the office nearest you, or write Dept. DB-52, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, N. Y. 17, N. Y.

In Canada: Union Carbide Canada Limited, Toronto 12.

UNION CARBIDE

BAKELITE and UNION CARBIDE are registered trade marks of Union Carbide Corporation.

ing wheels, rotary files, carbide burrs, routers, and sanding or cutting discs. Weight is 1¾ lb. Model 921-35, with ⅜ x 24 threaded spindle, is 6⅜ in. long. Model 921-45, available with ¼, 3/16, or ⅛-in. collet, is 5¾ in. long. Single-speed models also are available.—**Thomas C. Wilson,** Long Island City, New York, N. Y.

For More Details Circle No. 472—Page 39

DUST COLLECTOR

Dust collector features glass fabric bags to withstand constant operating temperatures up to 550° F. Bags are 11½ in. in diam and from

14 to 21 ft long. They are collapsed pneumatically to dislodge collected dust. Walkways are mounted at upper and lower service levels on the cylindrical collector. A caged ladder provides access to an upper internal inspection platform. Collector is said to be useful with cupolas and various types of melting furnaces.—**American Air Filter Co.,** 215 Central Ave., Louisville 8, Ky.

For More Details Circle No. 473—Page 39

TESTING MACHINE

Machine is equipped to perform tensile, compression, and guided bend test. Model TE-10-AS, shown here, has a capacity of 10,000 lb and is equipped with two gages to register applied load in two ranges. Motor and hydraulic power unit are located within the base of the tester with controls mounted on the front. As a tensile tester, machine holds specimens up to ½ in. thick by 1½ in. wide or ¾ in. in diam and up to 8 in. long. Space available for compression testing is 9½ in. high by 8 in. between the vertical pulling rods. Bend testing can be per-

formed on specimens of various thicknesses. Floor space required is 14 x 24 in., and unit is 74 in. high. It weighs about 500 lb.—**Steel City Testing Machines Inc.,** 8817 Lyndon Ave., Detroit 38, Mich.

For More Details Circle No. 474—Page 39

WELDING GOGGLES

Welding goggles are for use in gas welding, cutting, burning, and furnace operation. Units have ventilated side shields to keep out stray light and metal splashes. Eye cups have contoured surfaces and headbands are adjustable. Lenses meet commercial requirements. A similar model is offered for wear over spectacles.—**Air Reduction Sales Co.,** a division of Air Reduction Co., 150 E. 42nd St., New York 17, N. Y.

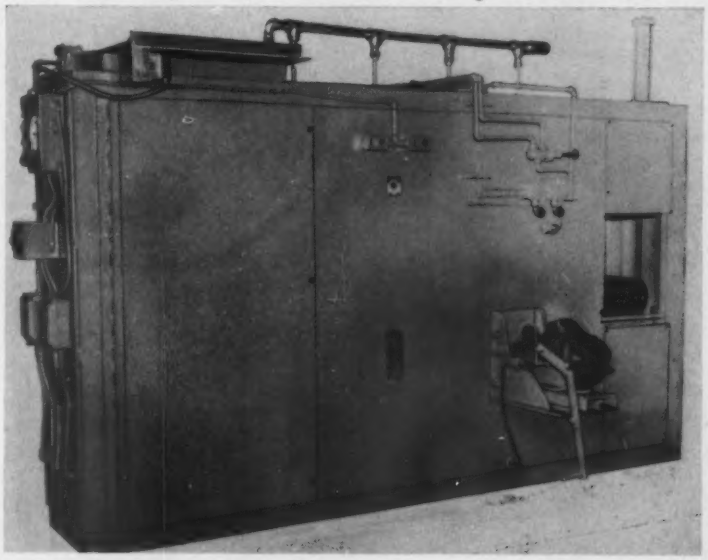
For More Details Circle No. 475—Page 39

COMPRESSED AIR FILTERS

Line of air filters cleans dirt, oil, and water from compressed air to be used for air-operated equipment of all types. On entering the filter, air flows downward through a wet filter cartridge where dirt particles as small as 2 microns or less in diameter and some oil and water are removed.

Drops of liquid which are too heavy to be carried by the air when it changes direction and flows upward, fall into the sump at the bottom of the filter. Before the air leaves the filter, it flows up through a dry cartridge which removes the remaining water and oil. Both cartridges are disposable

Centrifugal Unit Casts Iron Cylinder Liners



Centrifugal casting machine, Model MLS, operates in the horizontal position and is almost completely automatic. It can be used to produce cast iron cylinder liners at high production rates for applications in internal combustion engines and reciprocating pumps. Unit is said to turn out high quality liners with a minimum of labor and a low scrap rate. —**Centrifugal Casting Machine Co.,** Tulsa, Okla.

For More Details Circle No. 487—Page 39

NEW OSBORN QUIKORE*

DESIGNED FOR SMOOTH, STEADY HOT BOX OPERATION

Here's the latest in *advanced* foundry equipment by Osborn . . . the new QUIKORE Hot Box Blower . . . engineered for high speed, fully automatic production . . . Furan or shell —cores or molds. Even CO_2. QUIKORE units let you take full advantage of the new quick setting mixes. You can completely automate and speed up your production . . . cut time and costs . . . increase your profits. QUIKORE units assure smooth, dependable operation. An Osborn Foundry Specialist can help you evaluate the advantages of using the right QUIKORE unit on your production line. Write for complete details. *The Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland 14, Ohio. Phone ENdicott 1-1900.*

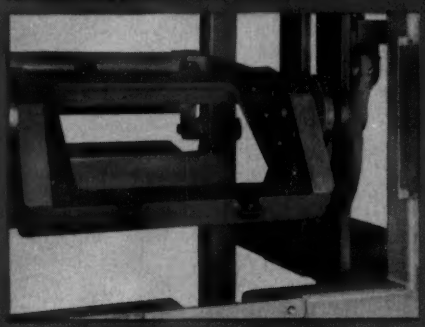
* Trademark

OSBORN®

Molding Machines • Shell Core Machines • Core Blowers • Metal Finishing Machines . . . and Finishing Methods • Industrial Brushes

Circle 614 on Page 39

PERIPHERAL TYPE GAS BURNER HEATING MANIFOLDS surround core boxes to assure fast, complete cure of every core.



OSBORN'S UNIQUE ROLLOVER MECHANISM* is built into the machine to roll over the drag half during its ascent.

*Patent Applied For

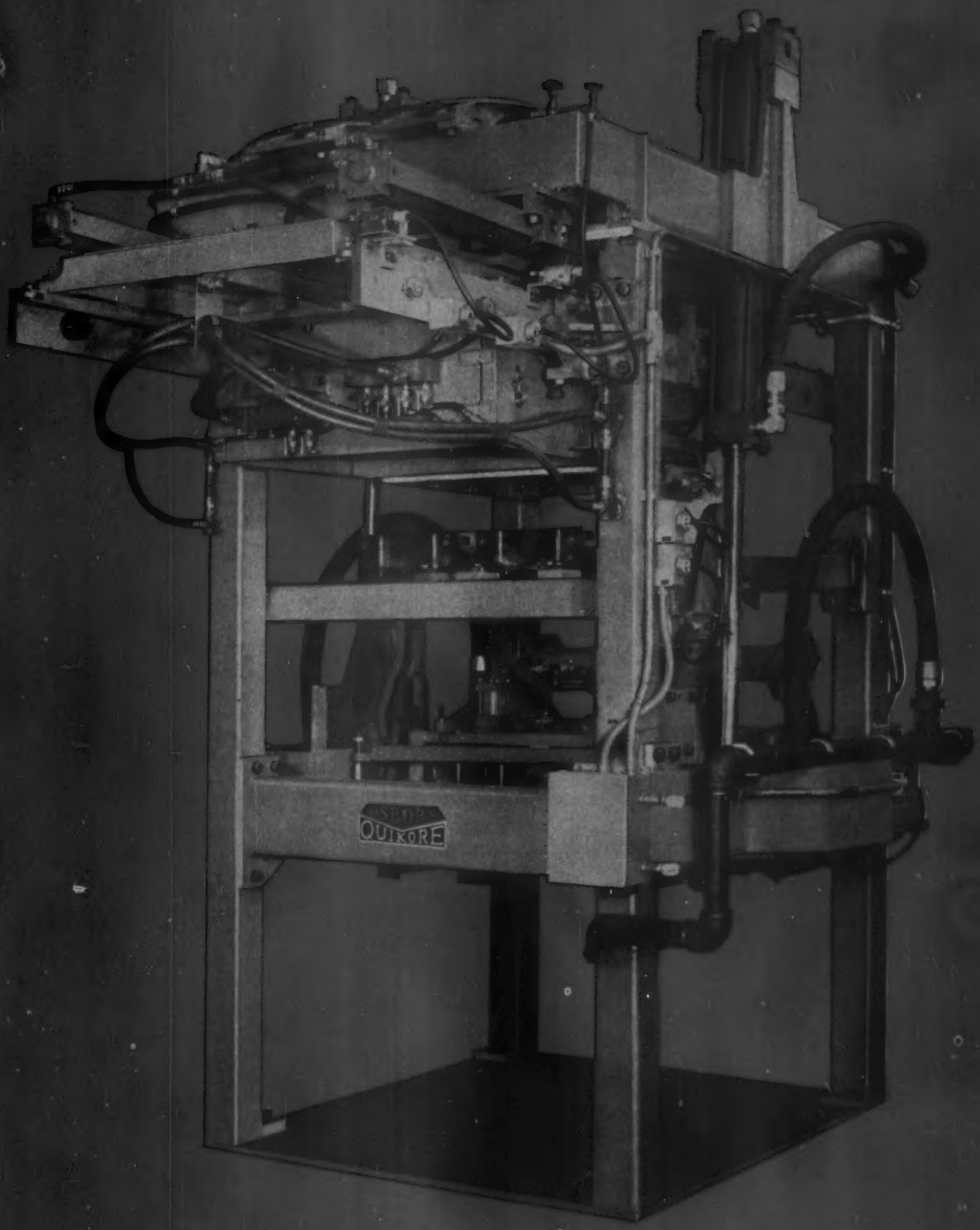
STRIPPING PIN ACTUATING MECHANISM is shown in position for automatically ejecting cores onto receiver or conveyor unit.

QUIKORE FEATURES

- Built-in rollover deposits cores on external receiver—minimizes core breakage and keeps operators out of the heat zone and blow area.
- All components are readily accessible. Rollover mechanism gives easy access to core box for cleaning and spraying.
- Sand reservoir is automatically shuttled out of heat zone during cure, prevents premature setup of mix.
- Mounted boxes assure continual perfect alignment.
- 3-inch blow valve and improved type sand reservoir give excellent blow and flow action.

OPTIONAL FEATURES

- Double-chambered sand reservoir allows blowing multiple cavities or two separate boxes.
- Stripping mechanisms for both cope and drag halves.
- Water-cooling when desired.
- Electric or gas heating for either or both halves.



OPERATING SEQUENCE:

Drag rises and engages cope, then moves up against reservoir and box is blown. Box moves down to area just above support ears for cope where final cure takes place. Meanwhile, reservoir has moved to fill position, bringing punch-out plate over cope.

Box continues downward after curing and cope is deposited on support ears. Drag moves on with core and is rolled over. At the same time, the punch-out penetrates cope blow holes and cleans them while assuring core or mold has stayed in drag.

A pneumatic stripping cylinder is then energized so that when drag half starts upward, core or mold is deposited on a receiver. This prevents crushing core against receiver. Machine is now ready for another cycle. Elapsed time: approximately 15-20 seconds, depending on cure time required.

and are easily replaced. Maximum flow rates range from 20 to 200 cfm and pipe sizes from ¼ to 2 in.—**King Engineering Corp.**, Ann Arbor, Mich.

For More Details Circle No. 476—Page 39

INDUSTRIAL TIRE

Industrial tire has two plies of steel cables imbedded in the rubber beneath the tread for protection

against puncturing objects encountered in scrap yards and other debris-littered areas. Tire is pneumatic and has an all-purpose tread. It is being produced in sizes to fit all popular material handling equipment.—**B. F. Goodrich Co.**, Akron, Ohio.

For More Details Circle No. 477—Page 39

VISIBLE DRAIN

Drain equipped with a transparent bowl permits visibility of accumulated moisture and sediment

and can be drained manually. Inlet is ½ in. female p.t. and is 5 in. in diameter at the widest point. Over-all height is 6¾ in. Unit is usable for pressures up to 150 psi and temperatures up to 120° F. Sump capacity is one pint. Metal parts are zinc diecastings with brass petcock. Bowl is plastic. It is claimed to be unaffected by water, naphthalene, motor oils, ammonia, and other materials. — **Wilkerson Corp.**, 1650 W. Girard Ave., Englewood, Colo.

For More Details Circle No. 478—Page 39

FINISHING MACHINE

Automatic finishing machine cleans, deburrs, and descales castings and produces a variety of finishes. It is designed to meet high production needs. Features include stainless steel construction, push-pull controls, indicating lights, adjustable blast guns, and self-unloading station.—**Hydra & Power-Blast Mfg. Div., Automation Services**, P. O. Box 5554, Detroit 38, Mich.

For More Details Circle No. 479—Page 39

PNEUMATIC GRINDER

Pneumatic grinder, Series 74G, is rated at 9000 rpm with a 4-in. organic wheel, 7200 rpm with a 5-in. wheel, 6000 rpm with a 6-in. wheel, and 4500 rpm with an 8-in.

wheel or a 6-in. wire brush. These speeds under loads are maintained by a sensitive governor. Prelubricated ball bearings support the ⅝-in.-11 spindle. Straight-handle models have either an on-off thumb flip throttle or a safety lever throttle. Grip handle models are available with a lever throttle. Stationary wheel guard, spindle washers, and nut to match wheel diameter are standard equipment.—**Buckeye Tools Corp.**, 5003 Springboro Pike, Dayton 1, Ohio.

For More Details Circle No. 480—Page 39

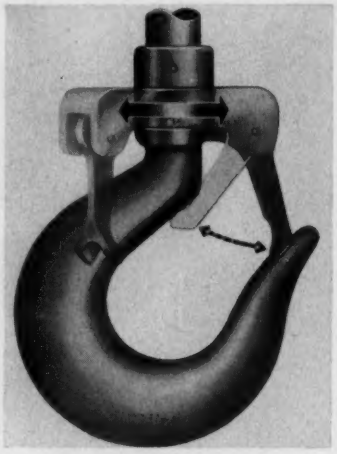
VIBRATORY FEEDER

Pneumatic vibratory feeder utilizes the manufacturer's one-piece, long-stroke air vibrator. A solenoid valve controls air to the vibrator and gives positive cut-off to eliminate dribble from the feeder. Operating air pressure is 35 psi. Unit can deliver more than 12,000 lb per hour.—**National Air Vibrator Co.**, 435 Literary Rd., Cleveland 13, Ohio.

For More Details Circle No. 481—Page 39

CRANE SAFETY HOOK

Safety hook for cranes and hoists is available in capacities from ¼ to 30 tons. Hooks for ¼ to 15 tons are drop-forged alloy steel, and 16 to 30-ton capacity hooks are cast steel. Safety catch, made of bronze, locks at two points. A load sling can be snapped onto the hook by operator without use of

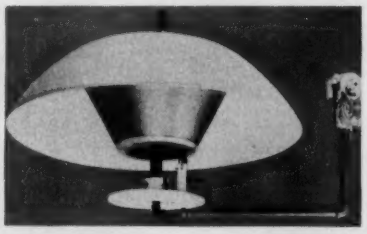


his hands, but when a full throat opening is required, the safety catch can be swung to one side by the operator. — **Shepard Niles Crane & Hoist Corp.**, Montour Falls, N. Y.

For More Details Circle No. 482—Page 39

OVERHEAD SPACE HEATER

Overhead infrared gas heater warms floors, men, machinery, and tools, yet leaves large dead storage areas relatively unheated to save fuel. Unit operates on either natural or LP gas and comes complete



with self-energizing thermostat for automatic operation. Components of the unit include a cone-shaped stainless steel infrared heat emitter, a large reflector, and a cast iron burner. Diameter is 33 in. and over-all height is 16 in. Weight of the unit is 33 lb, ready for installation.—**Space-Ray Corp.**, P. O. Box 3485, Charlotte, N. C.

For More Details Circle No. 483—Page 39

Circle 615 on Page 39→

Restore Costly Copper Components to Full Efficiency

AT A FRACTION OF REPLACEMENT COST!

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Foundry operators can now save thousands of dollars annually . . . dollars normally spent to replace costly copper components. Wilson Welding Company's patented process of restoring badly burned, pitted or scarred copper units to original specifications, or modified to meet your requirements, is guaranteed to perform and give life expectancy equal to that of new components.

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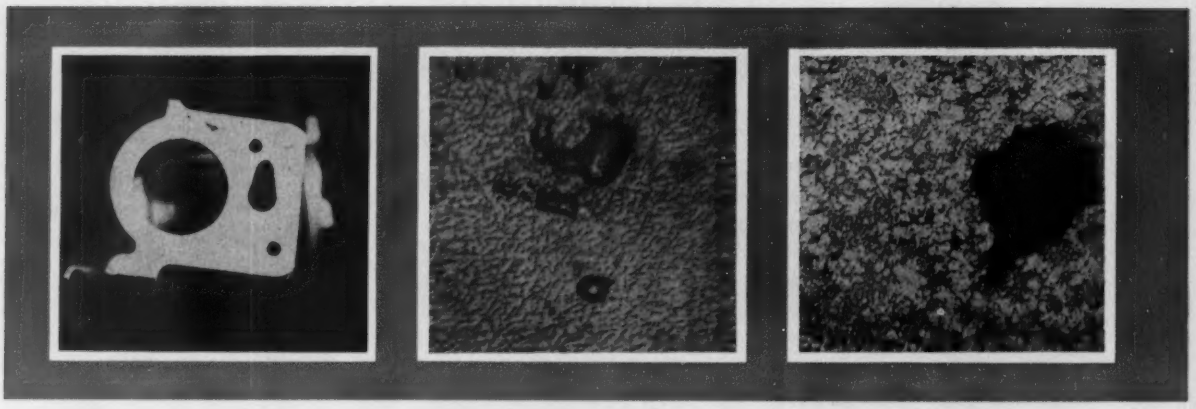


Fig. 1—Defect shown first was analyzed as shrinkage, but the real cause was entrapped gas

Fig. 2—Metallographic examination revealed reflective surfaces, a sign of gas entrapment

Fig. 3—Defect shown here is a shrinkage cavity. Compare appearance with defect in Fig. 2

METALLOGRAPHY

Identifies Diecasting Defects

This article, like "Sound Waves Improve Diecasting Quality" in the last issue, was presented at the first National Die Casting Congress & Exposition, sponsored by the Society of Die Casting Engineers

By G. L. ARMSTRONG
Chief Metallurgist
U. S. Reduction Co.
East Chicago, Ind.

and

R. H. HARDER
President
Lukens Aluminum Co.
Dayton, Ohio

● ALUMINUM DIECASTERS have become extremely conscious of the losses in time and money caused by repetitious diecasting defects. Proper identification of these defects when they first appear is extremely important to the achievement of consistently high quality and a high production rate.

The metallograph, which can be used to examine the surfaces of a sectioned casting microscopically, is a useful tool to aid in this identification. When subjected to microscopic analysis, diecasting defects frequently reveal to the diecaster why his quality and output rate are unsatisfactory. Properly performed, the analysis permits him to make the adjustments in metal and machine conditions which are needed to restore the casting cycle to the desired efficiency.

Sample Is Critical—Judicious selection of the areas to be viewed is critical. Since it is a magnifying instrument, the metallograph can photograph only a small area at one time. The technician preparing samples therefore must section and polish the parts of the casting most likely to contain the suspected defects.

Shrinkage and Gas—Porosity in a casting frequently is identified as shrinkage when in fact the defect was caused by entrapped gas. An error of analysis of this sort leads, of course, to lost time and effort.

The carburetor shown in Fig. 1 illustrates a situation wherein the defect was analyzed as shrinkage because the defective area is adjacent to a heavy section which might be considered a hot spot during the

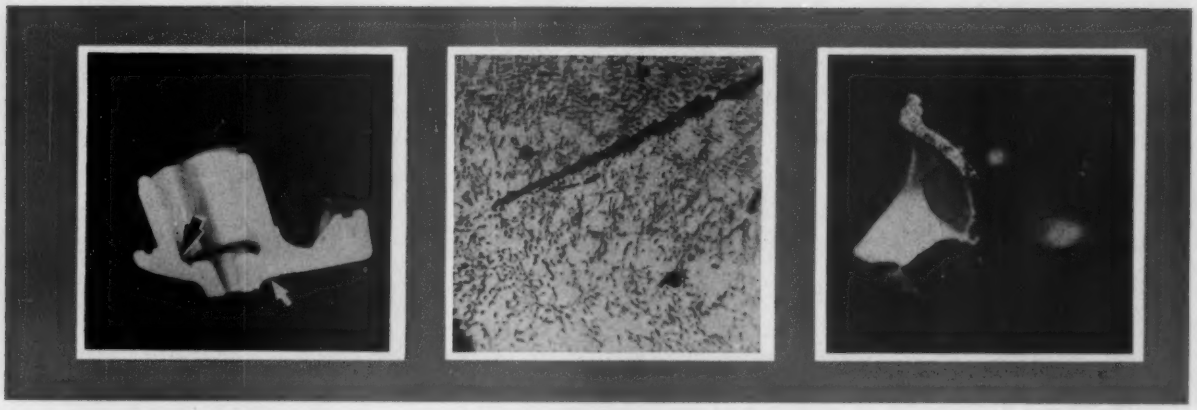


Fig. 4—This casting failed in a pressure test. Shrinkage indicated did not cause failure

Fig. 5—Further examination of casting in Fig. 4 showed porosity due to trapped lubricant

Fig. 6—Fractured casting shows coldshut areas which appear as flakes of unmelted metal

cooling cycle. Metallographic examination (Fig. 2), however, showed a high degree of reflection in the cavity—a positive indication of gas entrapment.

A shrinkage defect exhibits ragged edges and a dull cavity, whereas a gas porosity defect is rounded and highly reflective. Fig. 3 shows a shrinkage cavity and illustrates the difference in outline as compared with entrapped gas defects. A dissimilar internal cavity structure also is apparent. In the carburetor in Fig. 1, the quality problem was overcome by enlarging a vent in the die and incorporating an overflow pad.

The casting pictured in Fig. 4 failed in a pressure test in the area indicated. Shrinkage in this area was a strong possibility in view of the heavy adjacent section and the probability of a hot spot at the base of the threaded boss. When the casting was sectioned and examined, the voids in the center of the section proved to be shrinkage; but they did not extend to the outside surface of the casting and therefore could not be held responsible for pressure test failure. Farther up in the pipe section, however, pinhole porosity was observed.

As shown in Fig. 5, this porosity defect proved to be caused by trapped die lubricant. The small voids extended into the coldshut or physically inconsistent areas on the surface of the pipe section at the point farthest from the gate, thus permitting pressure leakage through the wall of the casting. It therefore was deduced that the pressure tightness problem was due to inadequate provision for vents and overflow pads.

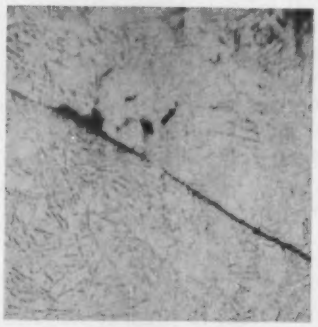


Fig. 7 — Metallographic section shows how metal of casting in Fig. 6 folded around lubricant

The metallograph can be put to good use when shrinkage appears in heavily cored sections because the depth, point of origin and direction of the shrink can be determined. When the information desired concerns the flow pattern of metal from the gate into the farthest reaches of the casting, an excess of lubricant introduced into the shot sleeve will mark the flow so that investigation of sections at 50X magnification reveal the precise pattern. Such studies are easy to perform since the samples require only the roughest of mounting and polishing.

Coldshuts and Die Lubricant Entrapment—Although casting defects due to coldshuts and entrapment of die lubricant or gas are almost identical in appearance, they must be controlled in different ways. Proper regulation of gate and runner size, metal and die temperature, and alloy specification can eliminate or minimize coldshuts. As noted previously, entrapped die lubricant and entrapped gas are treated similarly, by adjusting vents and overflows.

The fractured casting in Fig. 6 shows coldshut areas (of discontinuous metal) which appear as flakes of unmelted metal in the casting. Metallographic sections of these areas show how metal has folded to contain the die lubricant (see Fig. 7). The problem ultimately was traced to turbulence due to too large a gate.

The separation of coldshuts from entrapped lubricant can be seen by comparing Fig. 8 and 9. Areas of entrapped lubricant appear black at low magnification and extremely

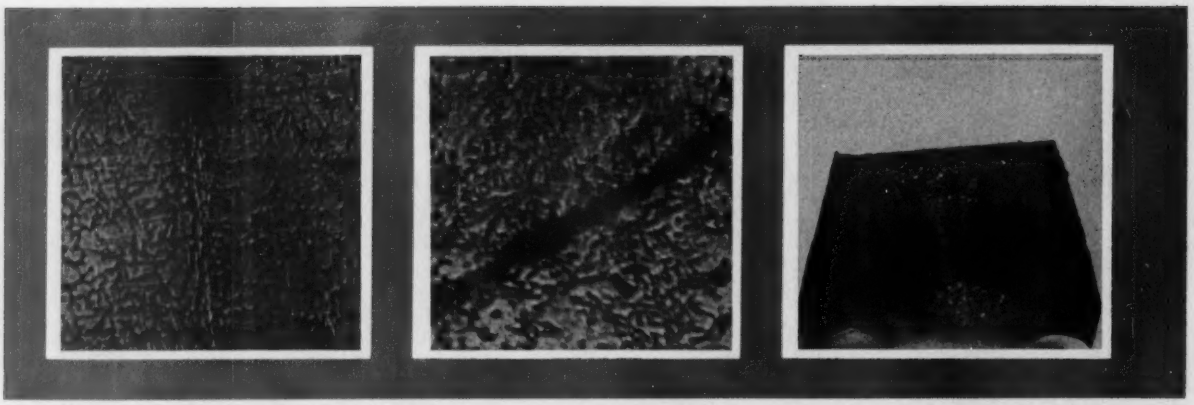


Fig. 8 and 9—Separation of coldshuts from entrapped lubricant can be seen by comparing these illustrations. Areas of entrapped lubricant appear black at low magnification and reflective at higher magnifications

Fig. 10—Aluminum oxide inclusions can impair machining by cutting tool life drastically

reflective at higher magnifications.

Nonmetallic Inclusions — Aluminum oxide (Al_2O_3) is the principal nonmetallic inclusion affecting quality which occurs in a diecasting. It occurs either as large, conglomerated masses or as much smaller, well dispersed particles.

The relatively large masses, which appear as black spots under low-powered microscopic examination, severely impair machining by reducing tool life drastically (Fig. 10). The smaller particles, seen as tiny dark specks on a polished surface, are detrimental to buffing, polishing, and plating operations, in which they cause tearing and pile-up of miniature "pinnacles" on the surface of the casting (Fig. 11). Their presence also seriously lowers mechanical properties of the casting. The small, scattered oxide particles are revealed by polishing a specimen and examining it at low magnification, unetched. Note in Fig. 12 that oxide inclusions do not resemble any common aluminum alloy phase.

Smaller oxide particles may develop from insufficient cleaning of returned scrap or from a gate and runner design which promotes turbulence. Larger oxide masses occur when ladling is careless or when metal cleaning or housekeeping operations are neglected. Frequently a casting may lose as much as 50 per cent of its normal mechanical properties through the development of oxide "lines" (Fig. 13) or areas where oxides have conglomerated to form a microstress riser (Fig. 14). Any force applied over areas so affected will cause a stress concentration at the defects, and the section over-all will assume the mechanical properties of the oxide-inclusion area.

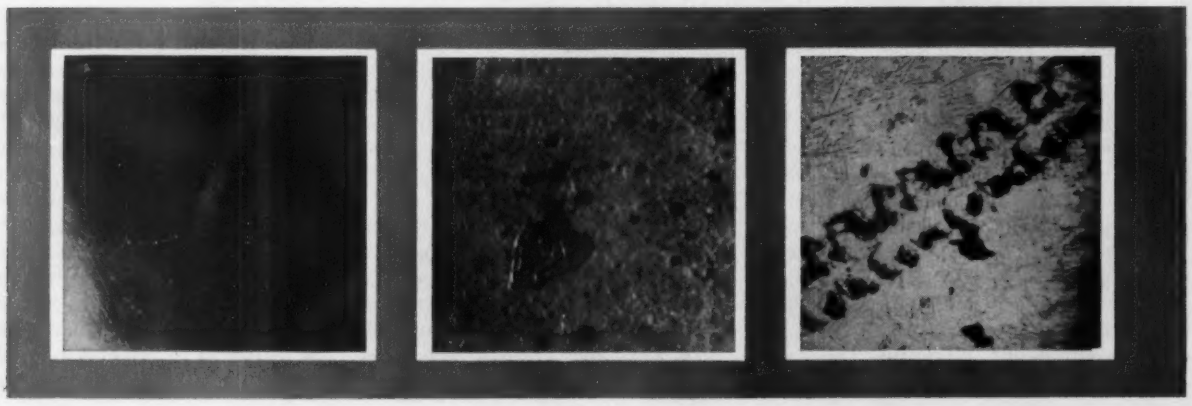
Molten aluminum can be fluxed with chlorine for effective removal of oxides, but a hood and ventilation system are required with the low-magnesium alloys because of fume generation. Fluxing removes oxides which occur in recharged scrap and on the surface of improperly stored remelt ingot. Because surface oxidation can become a safety problem during charging as well as a source of trouble in the casting cycle, ingot should not be stored outdoors.

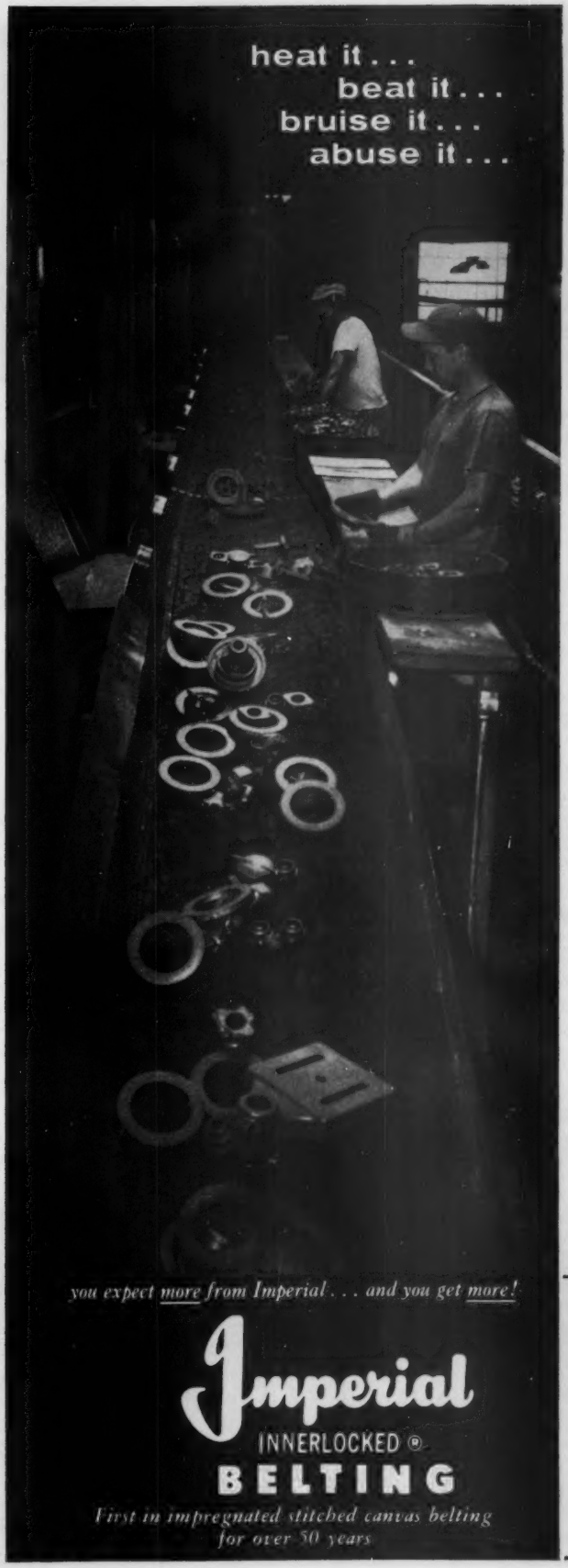
Another type of inclusion frequently encountered is a hard, metallic compound consisting of a

Fig. 11—Inclusions are harmful also during such finishing processes as buffing, plating

Fig. 12—These oxide inclusions do not resemble any more common aluminum alloy phases

Fig. 13—Inclusions in the form of oxide lines produce serious stress concentration at defects

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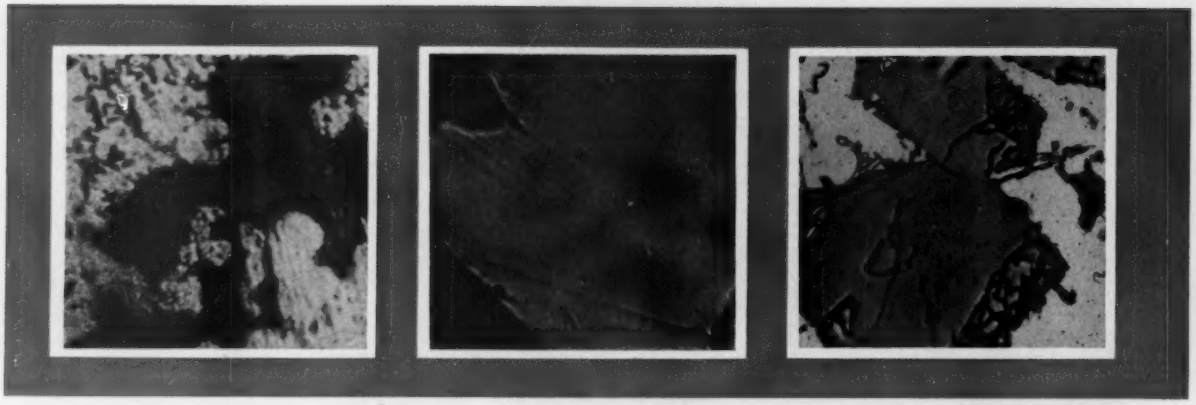


Fig. 14—Oxides in this example have conglomerated. Such areas cause stress concentration

Fig. 15 and 16—Sludge has several forms, most common of which is shown here. Different degrees of brightness on machined surfaces often are the result of sludge formation in the diecasting metal

complex of iron, manganese, silicon, and aluminum. This material develops in the melt for several reasons, usually from a formation of $MnAl_3$ at a cold spot in the melting pot. The $MnAl_3$ particles act as nuclei to precipitate iron, and silicon is taken into the complex to form a four-element sludge.

This sludge appears in several forms, the most common of which is shown in Fig. 15 and 16. A machined surface is not disrupted by unseen particles of finely divided sludge, but tool life is affected severely by large particles.

Moreover, castings finished by machining usually display different degrees of brightness.

Formation of large sludge particles reduces the fluidity of molten metal, promotes die soldering, causes tool breakage, and generally lowers the usually good handling characteristics of the alloy. Sludge may be taken back into solution by heating the melt to 1450° F and mixing. If sludge formation has become excessive, however, the furnace should be emptied and recharged with clean metal.

Sludging is accelerated by the presence of finely divided aluminum oxide particles which act as nuclei for precipitation of the Fe, Mn, Si, and Al complex.

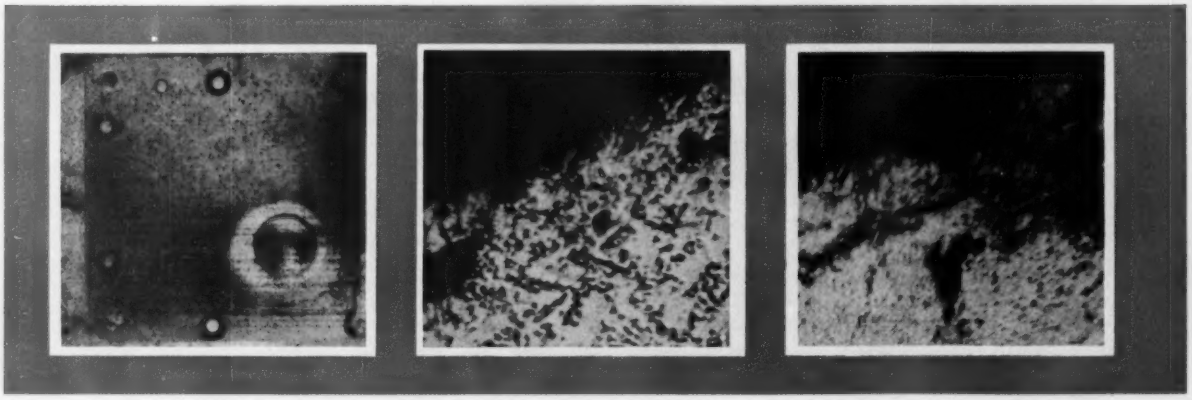
Anodized Castings—The defects which occur most frequently in anodized diecastings are those attributable to shrinkage, die lubricant entrapment, and oxide inclusion. Surface shrinkage is easily noted by staining of the color dye by entrapped electrolyte which "bleeds out" of the shrinkage fissures (Fig. 17). Lubricant and oxide defects will appear almost identically as dark clouded areas on the anodized surface of the casting.

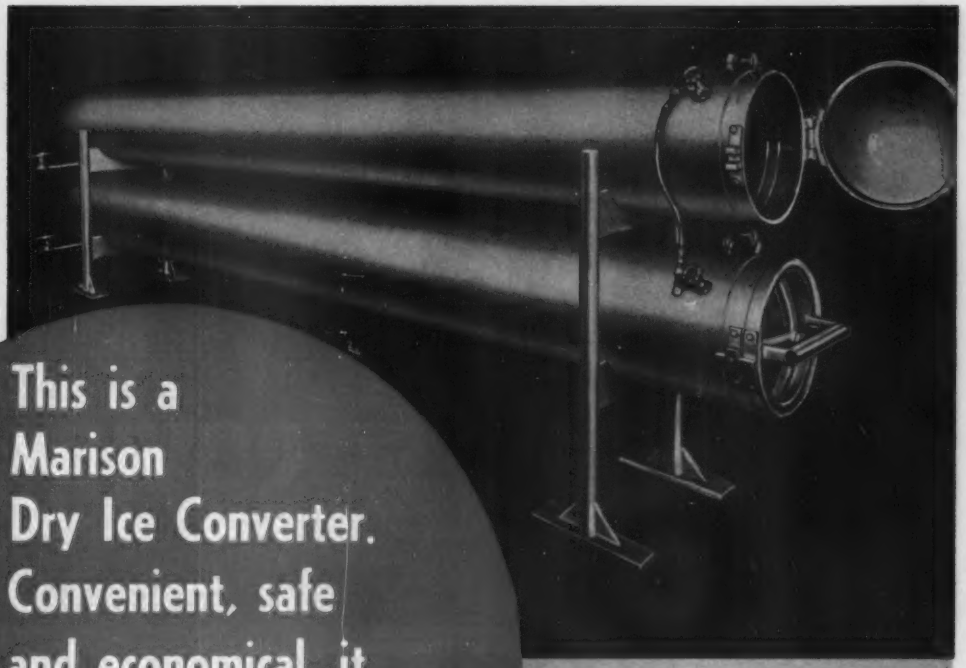
Although such a blemish frequently is attributed to lubricant, it more often is caused by oxides (see Fig. 18 and 19). These oxides usually can be traced to an inadequate metal cleaning operation or turbulence in the runner and gate. Where a buffing cycle has been employed, the surface of the casting should be examined at low magnification to check for the presence of oxides. This quality control procedure is particularly important when the anodized film is color dyed since color accentuates the defect.

● For an extra copy of this article, until supply is exhausted, use card on Page 39

Fig. 17 — Entrapped electrolyte has bled out of shrinkage fissures on this casting surface

Fig. 18 and 19—Dark clouded areas on an anodized surface of a casting often are caused by oxides which can be traced to an inadequate metal cleaning operation or turbulence in the runner and gate





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MANUFACTURERS, ALSO, OF TOP QUALITY "SEMI-STEEL" SHOT AND GRIT, MALLEABLE AND CHILLED SHOT AND GRIT — AT COMPARABLE SAVINGS!

Taylor & Boggis Foundry Co., Cleveland, former division of Consolidated Iron & Steel Mfg. Co., has been sold to a group of executives who have reorganized the firm as Taylor & Boggis Foundry Co. Inc. Buyers of Taylor & Boggis' Plant No. 2, at 2469 E. 71st St., Cleveland, are Frank P. Gill, Joseph Hanks Sr., and Ernest Thomas, who will be president, chairman, and vice president, respectively, of the new firm. Taylor & Boggis' Plant No. 1 was closed at the end of last December.

Investment Casting Co., Springfield, N. J., has appointed the following sales representatives: James F. Roberts Co., 1425 N. Illinois St., Indianapolis, to cover Indiana; C. S. Butler & Associates Inc., 1009 First National Bank Bldg., Cincinnati, to cover southern Ohio; and Marion T. Davis & Co., 595 Wimbledon Rd. N. E., Atlanta, to cover North and South Carolina, Georgia, and Florida.

Consolidated Mining & Smelting Co., Trail, B. C., has begun production of pig iron at its Kimberley, B. C., facility. Built at a cost of $7½ million, it has a capacity of 100 tons per day. This pig iron will be distributed in the United States by Associated Metals & Minerals Corp., New York.

Stovall Foundry, South Gastonia, N. C., suffered losses estimated at up to $200,000 when fire destroyed its pattern shop. Damage to molding facilities, situated in an adjoining building, was only slight. Operations are to resume as soon as the building is reconstructed.

Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland 3, Ohio, manufacturer of iron and steel abrasive shot and grit, has completed an expansion program in its Cleveland plant. The company also has made available to its customers the services of process engineers to solve problems pertaining to equipment, techniques, and abrasive materials.

Diamond Clamp & Flask Co., Richmond, Ind., closed down operations in December after 93 years of operation. All buildings, patterns, dies, jigs, fixtures, etc., are for sale.

Andover Pattern Co., Andover, Ohio, has completed an addition which increases floor space approximately 30 per cent and will house new equipment for melting and casting gray iron. The added facilities will be used to produce shell coreboxes.

Ilikon Corp., Natick, Mass., has opened new offices and a research laboratory in Natick Industrial Centre, Natick, Mass. The firm is engaged in research and development of new materials and their applications.

Wheelabrator Corp. of Canada Ltd., Scarborough, Ont., has been organized to handle sales and fabricating activities for all provinces in Canada. The new corporation succeeds the Canadian Div. of Wheelabrator Corp., Mishawaka, Ind.

General Electric Co., Silicone Products Dept., Waterford, N. Y., has appointed Frederic B. Stevens Inc., Detroit, to be distributor of silicone products for foundry use in the northeastern and midwestern parts of the country.

Wellman Bronze & Aluminum Co., Cleveland, is terminating its magnesium casting operations in that city. These operations will be

CRANE INSTITUTE: Newly elected officials of the Electric Overhead Crane Institute are (front row, l. to r.) G. E. Seavoy, Whiting Corp., alternate director; W. W. Peattie, Northern Engineering Works, president; H. W. Gledhill Jr., Shepard Niles Crane & Hoist Corp., vice president; (back row) R. A. Hossinger, Conco Engineering Works Inc., alternate director; Joe H. Peritz, executive secretary-treasurer; E. J. Sohn, Yuba Bedford Corp., director. Other new directors are R. F. Rice, Whiting Corp., and H. H. Bansau, Conco Engineering Works Inc.

HOW To Do It

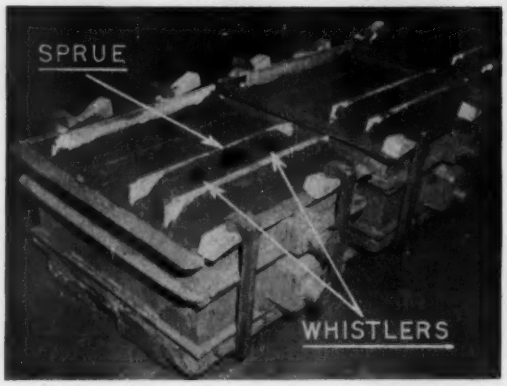
FOUNDRY will pay a minimum of $15 for each "How To Do It" idea submitted and published

Wooden Bars Increase Cope Depth To Accommodate High Pattern Areas

By FRANK VINEY
St. Catherines, Ont.

JOBBING SHOP foundrymen occasionally have the problem of wanting to fill an order for a few castings for which flask equipment of precisely the correct size is not available. We had such a job a short time ago in our foundry. A small area of the pattern was a little too high for the cope flask.

We were able to mold the job successfully by placing a wooden bar in the cope on each side of the high spot. The bars extended about 2 in. above the cope. Sand rammed over the high part of the pattern was held in place by the bars. The sprue was cut in this mound of sand between the bars, and whistlers were provided at high parts of the pattern.



A third wooden bar was placed near the opposite end of the flask to hold the bottom board level and provide solid clamping in the rollover machine.

consolidated at Bay City, Mich., where Wellman recently leased the Dow Chemical Co. sand and permanent mold foundry.

Casting Equipment Inc., Cleveland, a sales organization, has been formed by Allen J. Filipic and

J. D. Robbins

A. J. Filipic

J. Doyle Robbins, formerly sales engineers for Osborn Mfg. Co., Cleveland. They will represent foundry equipment manufacturers in Ohio, western Pennsylvania, West Virginia, and eastern Kentucky. Osborn has appointed the firm to be its exclusive sales representative in that territory.

American Zinc Institute has moved its Detroit headquarters to new and expanded facilities at 638 New Center Bldg., Detroit 2, Mich.

A. L. Swett Iron Works, Medina, N. Y., has discontinued operations. The firm was founded in 1873 and employed about 40 persons.

Heating Equipment Builders Elect at Annual Meeting

H. J. Pugsley, senior vice president, Swindell-Dressler Corp., Pittsburgh, was elected president of the Industrial Heating Equipment Association at its annual Winter Meeting in Dearborn, Mich., Jan. 23-24.

T. H. Wickwire, III, president, Trent Inc., Philadelphia, was named vice president of the association. Roy R. Snyder, treasurer, W. S. Rockwell Co., Fairfield, Conn., was re-elected treasurer; W. E. Benninghoff, vice president and Tocco Div. general manager, the Ohio Crankshaft Co., Cleveland, and R. M. Buck, president, Bryant Industrial Products Corp., Cleveland, were elected to the executive committee; and Robert E. Fleming was re-elected executive vice president.

H. J. PUGSLEY

New members of the board of directors are M. R. Ogle, sales manager, Drever Co., Bethayres, Pa.; T. H. Wickwire III, and G. C. Wilsher, vice president-engineering, Holcroft & Co., Detroit.

Approximately 125 top executives of the industrial heating equipment industry attended the two-day session.

P. A. Bennett, director, Metalworking Equipment Division, BDSA, U. S. Department of Commerce, spoke to the group on the special government programs for the industrial heating equipment industry. D. M. Keezer, McGraw-Hill Publishing Co., discussed the productive capacity of the capital equipment industry.

Procedures for government disposal of surplus property were described by John H. Williams, staff director, Production Equipment Division, Department of Defense.

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With more than three times the hourly capacity of the latest style vertical wheel mixer, the SPEEDMULLOR subjects each sand grain to the same mulling action batch after batch. Uniformity and thorough mulling are not sacrificed to meet high production needs.

Only SPEEDMULLOR installations provide fully developed physical properties* within *practical time cycles* giving sand of unmatched uniformity while outproducing even the latest models of the so-called new multiple continuous mixers.

Continuous mulling was proved ineffective by B & P research as far back as thirty years ago in their quest for high speed, high quality mulling. The unit ultimately developed by B & P into the finest muller in the field today, is the SPEEDMULLOR—the only really new development in sand mulling in thousands of years. Its modern rubber to rubber design utilizes centrifugal force resulting in the fastest, most thorough mulling, while using long wearing, lightweight rotational parts.

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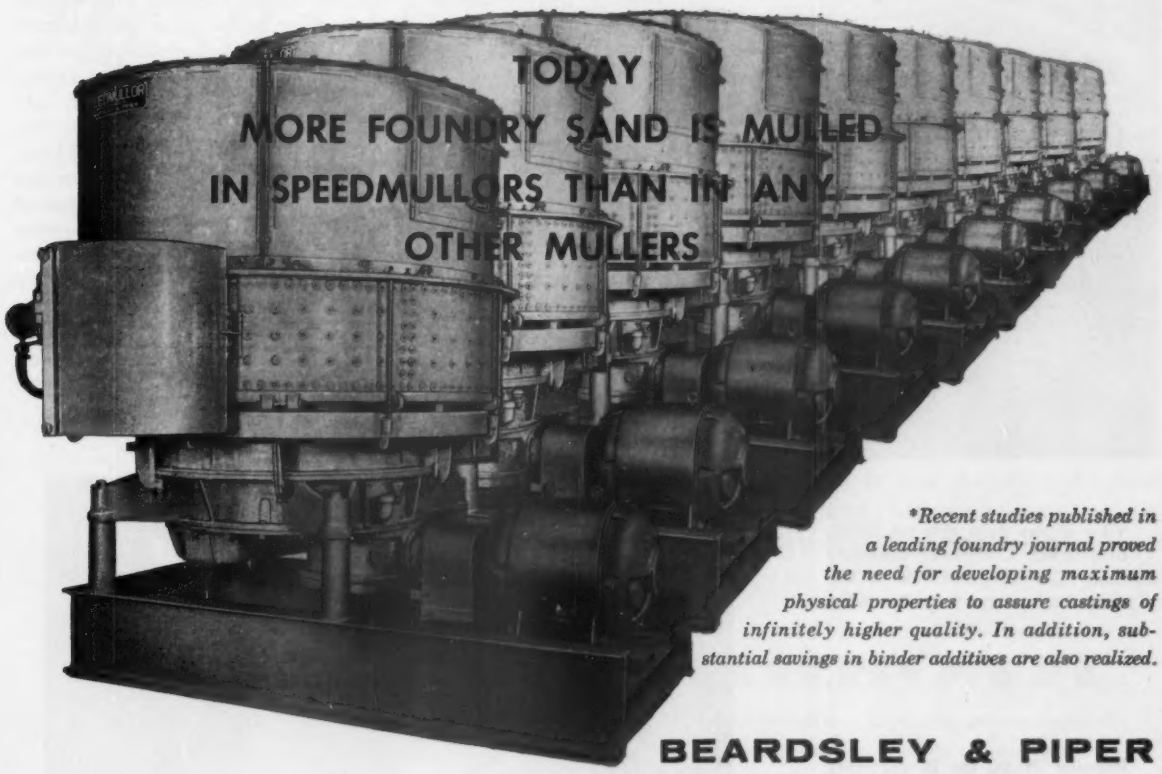

**Recent studies published in a leading foundry journal proved the need for developing maximum physical properties to assure castings of infinitely higher quality. In addition, substantial savings in binder additives are also realized.*

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Circle 619 on Page 39

Workman inspects drag half of impeller mold following curing. Cope and its special arbor can be seen in the background

5—Ton Impellers Cast in MANGANESE BRONZE

● BETHLEHEM STEEL CO.'s San Francisco shipyard has successfully cast four 10,000-lb high-tin manganese-bronze impellers for new type, high-capacity vertical diversion pumps. These Byron Jackson pumps will be used in a power project now under construction. The castings are the first of their type and size to be made.

Measuring 60 in. in diameter and 45 in. in height, the impellers resemble a giant, stubby screw, unpointed and with four helical ribs or threads.

Although extremely complex, the job was successful from the very first pilot casting, which had been carefully planned in advance.

The mold for the impeller was made up of 13 cores plus a cope and drag. The most difficult part of the job was accurate assembling and lining up of the core sections.

A special cope, with arbor, had to be designed for the casting. The arbor, fabricated from steel H-sections and pipe, served two purposes —to support the central section of the cope, and to permit placement of a full-ring riser. Molding practice included use of sodium silicate binder and gassing with CO_2.

The metal was bottom poured at a temperature of 1850° F. A complete pour required only four minutes.

View shows core sections being assembled. Completed assembly then must be positioned in the drag half of the impeller mold

Impeller is 60 in. in diameter and 45 in. high. It will be used in one of four pumps destined for a power project

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..FOUNDRY DEVELOPMENTS

By EDWIN BREMER
Metallurgical Editor

Saves Power

INVESTIGATIONS by the British Iron & Steel Research Association (London, England) have shown that a good guide to efficient use of power in electric arc furnaces is the temperature of the roof refractories, and that there are optimum voltages for each part of the steelmaking process. This study led the association to develop an automatic power input controller (APIC) which controls the order of events in the furnace according to time and attainment of predetermined values of roof temperature or rate of temperature rise.

The system includes roof temperature and rate of temperature rise measuring devices connected to a potentiometric controller, a synchronous time relay, and a two-direction stepping switch actuated by both the timer and the temperature controller.

Improves Control

ELECTRODE drive system based on hydraulic operation and voltage control employing the hydraulic jet-pipe principle developed by Askania Regulator Co., Chicago, is reported to provide improved control in vacuum arc melting. System is discussed in a paper "Arc Improved, Consumable Electrode Vacuum Arc Melting Furnace" presented by A. L. Field Jr. and K. L. Bryant, E. I. du Pont de Nemours & Co., Wilmington, Del. at the recent meeting of the American Institute of Electrical Engineers.

It is reported to maintain a voltage sensitivity of plus or minus ¼ volt, and the total time delay for activation of the electrode shaft after a voltage differential is noted, is not in excess of 3 milliseconds. Controls are centralized in a remotely located console and permit one-man operation.

Keeps Close Tabs

CLOSE control on alloy compositions is maintained at Ampco Metal Co. Inc., Milwaukee, by means of a direct-reading spectrograph. That instrument is linked to 30 melting furnaces in the foundry by a 900-foot pneumatic conveyor system for forwarding samples to the laboratory, and returning reports to the furnaces.

Two full-time and one part-time technicians, during three months of operation of the system, made 4500 analyses determining 36,000 elements. During that period, 3 million pounds of metal were poured without scrapping a heat. Spectrograph was supplied by Applied Research Laboratories Inc., Glendale, Calif.

Color Is a Guide

STUDY of the fracture test of chilled bars for estimating melt quality of the 85-5-5-5 alloy, conducted by Shigeo Oya and Umewo Honma, is discussed in "Rapid Routine Test of the Melt Quality of 85-5-5-5 Red Brass," published in *Report of the Castings Research Laboratory*, No. 10, 1959 of Washeda University, Tokyo, Japan.

The authors indicate that presence of small amounts of aluminum, silicon, and manganese tend to cause incorrect estimation of melt quality from the fractured surface. They claim that these elements can be detected by pouring specimens in small graphite crucibles and examining the appearances of the wall and top surfaces.

Investment Castings

ACCOMPANYING illustration shows investment cast parts which form key units in the breaker section of a low-voltage, air-circuit breaker built by Allis-Chalmers Mfg. Co. The intricate shapes are produced by Arwood Corp., New York, and from left to right are the closing cam, trip lever, operating cam, and another trip lever. Due to complex geometry and intricate coring, Allis-Chalmers selected investment casting as the only feasible method for production.

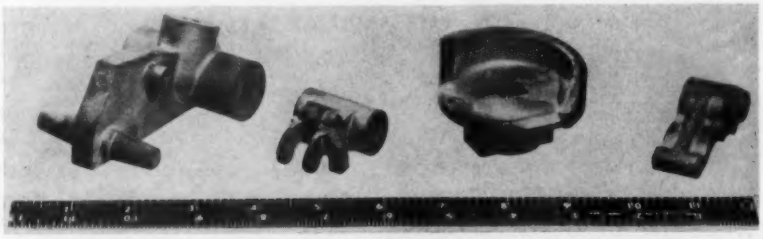
Resists Corrosion

ENGINEERS at the Weyerhaeuser sulfite plant, Everett, Wash., have found that stainless steel castings are providing long-life results in tubular headers which conduct hot, corrosive sulfur dioxide gas from the sulfur burners to the cooling pond. The sulfur dioxide is used to form calcium bisulfite which is employed to manufacture sulfite pulp.

Castings in the headers include elbows, T manifold, and numerous straight and reducing sections. They are made from type HH (Alloy Casting Institute designation) austenitic stainless steel. The alloy, containing 25 per cent Cr and 12 per cent Ni, is reported to have excellent high-temperature strength as well as high resistance to sulfur-bearing gases under oxidizing conditions.

Resists High Heat

NEW organic fiber developed by Minnesota Mining & Mfg. Co., St. Paul, Minn., is reported to be resistant to temperatures as high as 18,000° F. Called Pluton, the material does not conduct heat or electricity. It is said that molten steel at 3000° F poured onto the fiber will solidify without charring or melting it.



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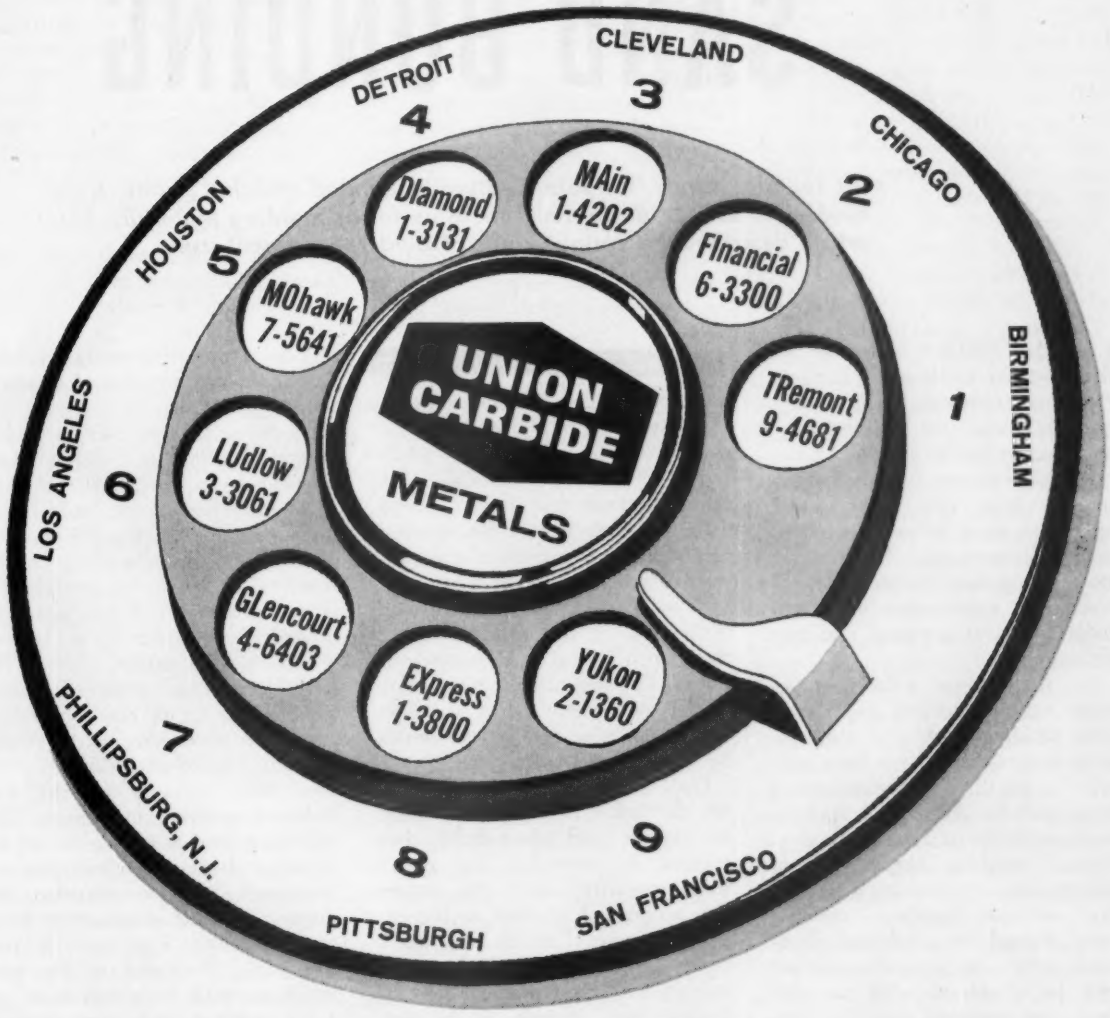

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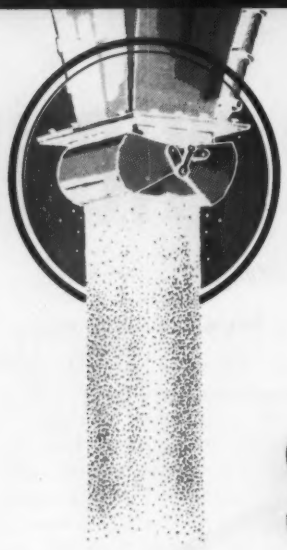

By W. P. WINTER
Assistant Professor
Pennsylvania State University
and
Sand Consultant, Royer Foundry & Machine Co.

SAND BONDING

All foundry sands, including naturally bonded molding sands, need binders of some type to make them useful as molding materials. This article describes the various kinds of binders in current use

● IN A PREVIOUS article in this series, the statement was made that sand substance alone is not especially useful for molding purposes since it has no bonding qualities. Cohesiveness is provided by binders, which vary in type and amount to meet different applications. Binders can be grouped into molding sand binders used for green sand applications and sand binders used for dry sand and core applications.

The fundamental differences between natural molding sand, synthetic molding sand, and semisynthetic sand already have been covered. In all three, if the mixture is being used for green sand applications, the binder is likely to be clay. Natural molding sands contain, among other components, a natural clay, whereas synthetic molding sands depend on a selected, processed clay. In general, moisture must be considered with the clay since it is hydrated clay that provides bonding action.

If a sand-binder mixture is prepared for dry sand molds or cores, the bond is likely to be some material other than clay. There are many such special binders, and the fundamental action of one may be quite different from that of another. In addition, different amounts of any given binder may create major differences in the properties of the mixture.

The word "clay" is used to designate any of a group of mineral substances varying from pure white kaolin to refractory fire clays. A rather concise and highly useful definition calls clay a fine-grained rock which when crushed and pulverized becomes plastic when wet and leather-hard when dried and converts to a permanent, rocklike mass when heated to high temperatures. This definition is satisfactory to the foundryman, since it covers the fundamental actions with which he is concerned.

Only one additional factor might be clarified. Although the clays do become hard when dried, they respond to rewetting and regain their plasticity; they also impart this action and reaction to the entire aggregate of which they are a part. Only clay which comes in contact with molten metal may be heated high enough to be permanently changed.

Clay-water systems and clay-water-sand systems can be explained in terms of clay chemistry and physics, but the production foundryman is more concerned with the effects. Different clays affect density and ease of ramming variously. In general, small particle size and high moisture absorption properties impart highest molding sand strength. Increasing amounts of clay cause increasing strength values, toughness, and amounts of moisture needed for temper.

At the same time, increased clay reduces flowability, deformation, permeability, and expansion. With equal ramming energy, mold hardness increases as clay content increases, and the ramming of the mold has a great deal to do with successful production of castings. Fig. 1 and 2 illustrate these factors.

Reference to natural clay in the natural molding sand is inexact since all types of clay occur naturally in reasonably extensive deposits. The major difference is, more likely, a matter of purity. Extraneous materials in common clay substance tend to reduce the refractoriness of the clay and the cohesiveness and to increase the amount of water necessary to bring out plasticity. This point is, perhaps, best illustrated by the generally accepted facts that most natural molding sands work best at clay levels much higher than synthetic sands, require moisture contents often twice that of most synthetic sands, and generally are not suitable for steel work.

When it comes to preparing synthetic molding sands, foundrymen usually are dependent on processed clays. These are pure forms of four recognized types of bonding clays known as kaolinite, montmorillonite, halloysite, and illite.

Kaolinite — Kaolinite, essentially hydrated silicate of alumina, is the chief constitutent of China clay and fire clay. It is made up of relatively large particles consisting of crystals and flakes measuring as much as 20 millimicrons thick. Density of fire clay is perhaps higher than that of other clays, and it has moderate effects on green strength and dry strength.

Montmorillonite — Montmorillonite occurs in two forms, western bentonite and southern bentonite which differ in base exchange ions. The base exchange ion in western bentonite is sodium; in southern bentonite it is calcium. This fact accounts for major differences in the behavior of the bentonites when they are used as bonding clays for synthetic molding sands.

Western Bentonite—Western bentonite has a flake form much like that of southern bentonite, with a thickness of about 1 millimicron. Both have the tendency to open up in accordion fashion when wetted. Western bentonite provides moderate to high green strength and high to very high dry and hot strength. It is noted for its gel-forming characteristic, which lowers flowability and increases difficulty in ramming. Western bentonite decreases rammed density, whereas most other clays increase this property.

Southern Bentonite — Southern bentonite contributes more to green strength and less to dry and hot strength. Also, it has good flowability and collapse. Although both bentonites have a lower refractory value than kaolinite, they have great value as bonding clays in the preparation of foundry sands.

Halloysite and Illite—Both halloysite and illite are used less commonly in molding sand. Illite behaves much like kaolinite except for a lower refractoriness. Halloysite displays a higher refractory value and has a rodlike structure rather than the platelike structure of the bentonites. Both of these clays generally are used more as blends, either natural or prepared.

Table I is a simplified tabulation of some of the more important properties of these clays. With any given amount of clay, maximum attainable green compression strength runs highest with southern bentonite, followed, in order, by western bentonite, halloysite, kaolinite, and illite.

Special Binder — Although most castings are produced in moist, clay-bonded sand molds, at least one bond is a claylike material which is not wetted with water. Since this behaves like green sand, it must be included here.

TABLE I—Properties of Clays

	KAOLINITE (Fire Clay or China Clay)	WESTERN BENTONITE (Sodium Bentonite)	SOUTHERN BENTONITE (Calcium Bentonite)	HALLOYSITE White Clay	ILLITE
Particle Size	Relatively large crystals and flakes	Both bentonites are small flakes which expand accordion fashion		Rodlike particles	Same as kaolinite
Refractory Level	High	Low	Low	Very high	Low
Effect on Green Strength	Moderate	High	Very high		
Effect on Dry Strength	Moderate	High	Moderate		
Effect on Air-Set Strength	High	Little	Little	High	High
Effect on Hot Strength	Intermed.	High	Very low		
Flowability	Moderate	Moderate	Good		
Collapsibility	Fair	Poor	Good		
Other Notes	Low expansion	High expansion, durable	Low expansion	Easy to work	Good dispersion

The binder is a formulated substance produced from bentonite by a chemical conversion. It develops excellent bond in the presence of a petroleum oil and catalyst. Water is neither required nor desirable. Sharp sand of fine grain size is mulled with the bond and oil in the presence of methyl alcohol as the catalyst.

After preparation in standard equipment, the molding sand can be used in conventional manner without some of the problems of overramming and moisture content. Also, it can be reused after remulling, often without further additions. Some applications favor this mixture as a facing, and in others it is used to make the entire mold. Smooth surfaces and accurate details are claimed for this sand, which develops compression strength of about 12 psi and works best when rammed to mold hardnesses above 80.

Modern foundry practice demands fast baking or curing dry sand molds or cores of good strength and collapsibility. There should be a minimum of gas evolution and little or no distortion during baking and storage. A good binder will not absorb moisture during storage. The material must lack stickiness both as shipped and after it has been mixed with sand and other additives. Above all, it must be economical to use. For this discussion, dry sand binders will be classified as air-drying binders, binders treated with a catalyst, and baked binders.

Air-drying Binders—The vast majority of binders used in dry sand and core work require some secondary treatment to promote optimum strength. Some harden at room temperature. These materials often require considerably more time to cure than those which receive special treatment, but they may be valuable for special applications. These include sodium silicate and portland cement.

Sodium silicate used in this way must not be confused with the now popular CO_2 process although the starting point is the same. For some time this material was recognized as a binder, and hardening was an air-drying process. The resultant core developed good strength, but lacked collapsibility. The difficult shakeout feature probably prevented widespread applications.

Portland cement sometimes is used where large, heavy ferrous work is being cast. About 8 to 12 per cent high-early-strength hydraulic cement by weight conventionally is rammed against patterns or into coreboxes for forming. The material must be air-dried for about 72 hours, after which it is hard and strong. Better accuracy for large work is claimed.

Rubber cement, certain of the chemical cements such as oxychloride, and the silicon esters such as tetraethyl ortho-silicate are binders for special work. Treated rubber

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latex, used in a patented process, is added to tempered sand as a binder. Air-drying time for oxychloride is approximately 48 hours. The silicon esters owe their binding action to the fact that they hydrolize in the presence of water, forming alcohol and silicic acid. When the alcohol evaporates, an adhesive silica bond results.

Treated Binders — Several newer materials or newer applications of older materials should be included under this heading. They do not harden in air alone, yet do not require the more conventional application of heat as in baking.

Of the several examples of binders in this classification, sodium silicate hardened by the application of carbon dioxide gas is perhaps the most commonly used. Sand is mixed with a fairly low percentage of liquid sodium silicate, hand rammed or blown into coreboxes or flasks, and treated with carbon dioxide long enough to force gas through the mass. Hardness immediately becomes high enough so that the resultant core or mold can be used at once. The bonding action comes from the formation of colloidal silica during the reaction.

Cores and molds made by this process generally are noted for poor collapsibility. This property can be improved and controlled effectively by the addition of selected additives, notably sugar. In some instances, poor flowability has been a problem, but the proper additive—for example, fly ash—will overcome this. The real value in this process is the speed with which the sand aggregate can be hardened without over-baking.

Another relatively new type of binder sets partially in unheated air, then is baked. In this process, binder plus oxidizing agents and catalysts are mixed with sharp sand. Depending on the amount of catalysts sand temperatures, and temperature of the atmosphere, the mix offers a predetermined amount of time for core fabrication. The mass is allowed to air dry until it has developed working strength. It then is removed from the corebox and baked to develop final strength.

Baked Binders—By far the most generally used dry sand binders are those which require only heating or baking to develop strength. The actual transformation may vary, but

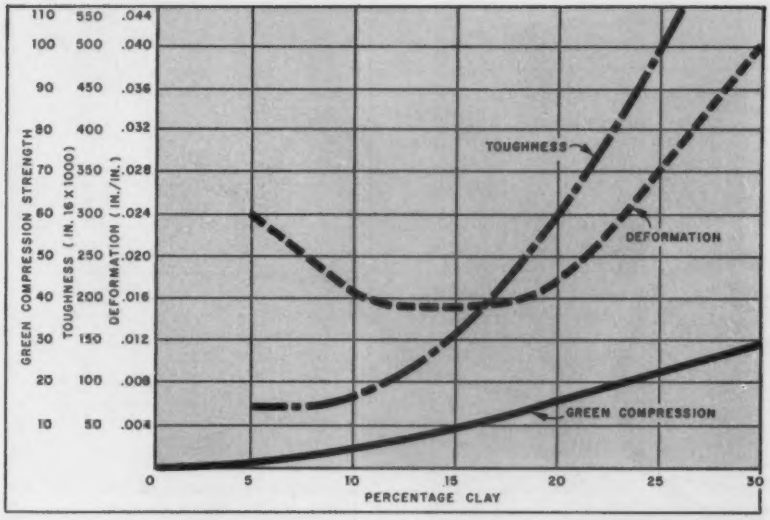

Fig. 1—Graph shows how adding clay to a molding sand affects such important properties as toughness, green compression, and deformation

heat is the necessary activator. All of the drying oils, cereals, natural and synthetic resins, pitch, and many others are included in this group.

For purposes of discussion, three subgroups will be used. The most convenient groupings are (1) oil binders that dry on being heated, (2) resin binders that are thermoplastic or thermosetting, and (3) cereal binders that adhere on being heated.

Oil Binders—Drying oils, including vegetable, mineral, and some animal oils, constitute this group. Vegetable drying and semidrying oils are products of fruits of plants or trees. They are extracted from seeds or fruits and owe their value to their ability to combine with oxygen to form solids. Linseed oil and China wood oil or modern synthetic duplications of these oils are the most common. Properly used, they form hard films over sand grains when they polymerize in an oxygen atmosphere, thus creating a bond.

Proper baking includes a period of water evaporation followed by a period of holding at oven temperature, with a supply of oxygen, to promote polymerization and finally by a period of cooling to room temperature when they are ready for use. Temperature levels, oxygen concentration, moisture level, and oil composition are the major variables present.

In general, core oils possess very little green strength and for this reason clay or cereal or both, with the correct amount of water, are added to provide green strength. Care must be exercised, however, since clay may increase greatly the amount of oil needed. Core oils are made to fulfill many special requirements, and their composition depends largely on the size and type of castings to be made.

Although not so commonly used, mineral or petroleum oils have value as sand binders. Instead of being used in their natural state, they are polymerized partially to form the basis for quick-drying, oil-like binders. When such materials are baked, they harden into the typical hard film. They differ in chemical structure from the vegetable drying oils.

One process variation makes use of an oleoresinous binder which consists of a natural mixture of an essential oil and resin. It is most like an oil binder, is handled with standard equipment, and (Fig. 2) has very little green strength, but develops baked tensile strengths of approximately 250 psi.

Resin Binders—Like the oils, resin binders require heat; unlike the oils, however, they do not require oxygen. Some of the binders in this group soften or melt when heated, and strength is obtained when they harden during cooling. These are the thermoplastic binders. Other materials become harder on being heated instead of softening. They

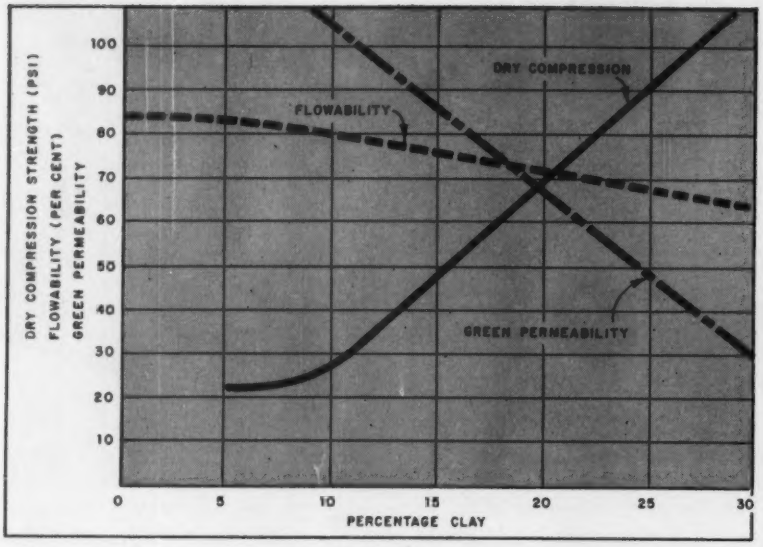

Fig. 2—Additions of clay to molding sand will lower properties such as flowability and green permeability, but will increase dry compression

are called thermosetting binders.

A number of natural resins including gum rosin, wood rosin, petroleum resins, pitch, coal tar resins, and the synthetic resins belong in this group. As a group, such binders provide moderate to high strength at low cost and often can be used with clay-bearing or reclaimed sands when other binders would not work as well. They bake rapidly at reasonably low temperatures and make cores with good collapsibility. They usually are nonhygroscopic.

Cereal Binders—The cereal binders, sugars, and some other valuable materials develop their strength by a simple process of evaporation of water. This is the least complex of the baking actions.

Sulfite liquor or lignone is heavy dark liquid or brown powder formed as a byproduct of the papermaking industry. These materials are completely soluble in water and tend to migrate to the surfaces as the water migrates during drying. Clay and other fines help to counteract this action. Because of this binder migration, sharp sand is not recommended for use with them. These binders bake rapidly and do not tend to ferment. Like most soluble binders, they are hygroscopic and may weaken in storage because of atmospheric moisture. One common use for them is as water solutions sprayed on molds and cores to create harder surfaces with better resistance to high temperatures.

Protein binders—organic compounds such as gelatin, casein, and glues—have good bonding power. They create low green strength, but dry rapidly under 400° F, making a mass with highly satisfactory baked strength. In general, they have a low burnout point and are best when used with sharp sand.

Cereals used in the metalcasting industry are any of a number of materials derived from the cereal grains. They often are finely ground, flourlike materials. Cereals provide good green strength when used as a binder, and, in other applications, are used as molding sand additives. The most common forms are gelatinized starch, dextrin, and a few others, all of which are highly soluble and mix well. This ability to mix helps when the main binder must be supplemented.

Cereals tend to be sticky and may create a slight problem when used in too great proportions. This type of binder provides, in addition to good green strength, a quick drying binder with fast burnout and complete collapsibility. Unlike clay, cereals do not absorb oil when used in a combination with core oil. In situations where it proves best to use both cereal and oil in the sand mix, the mixing order and cycle may be more important than other details.

Since there are many binders with suitable properties and numerous minor variations, it is necessary for the foundryman to select his materials from a reliable dealer or producer and then test out applications to meet his specifications. What one man finds suitable may not satisfy another, and a given set of properties may be had in several different binders or combinations of binders. Depend on your dealer and then use properly what he provides.

● For an extra copy of this article, until supply is exhausted, use card on Page 39

MAPI Publishes New Book on Cost Reduction and Profit

Machinery & Allied Products Institute has published the pamphlet *Cost Reduction and Profit Improvement*. It contains observations on reducing costs and improving profit in manufacturing, marketing, purchasing, and finance. The views in the pamphlet emphasize the responsibility of top management and also the need for team effort.

The booklet can be obtained from Machinery & Allied Products Institute, 1200 18th St. N. W., Washington 6. The cost for each copy is: 1-9 copies, $1.50; 10-39 copies, $1.25; 40-89 copies, $1.; 90-149 copies, 89c; 150 copies or more, 75c.

AFS Publishes New Manual For Use By Patternmakers

American Foundrymen's Society has published a *Patternmakers Manual* containing tables, charts, diagrams, and formulas for use by trained patternmakers or for the training of patternmakers. Subject matter ranges from the aptitude required to be a patternmaker or foundryman, to new materials, methods and applications, and case histories which help solve some of the intricate problems of patternmaking and casting. The 406-page manual was edited and written by experts in patternmaking and foundry work. Price of the manual is $6.50 to AFS members and $9 to nonmembers.

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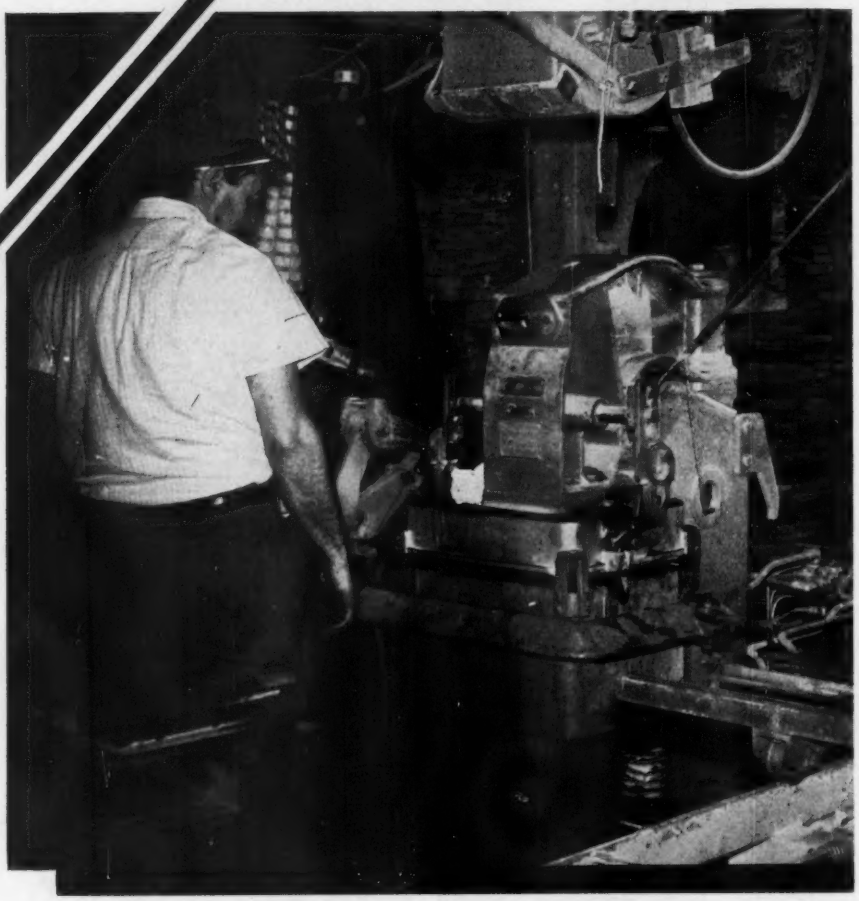

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MAN TO MAN....

By RALPH L. LEE, *President*
Lee Hobby Foundry, Birmingham, Mich.

Foundry Discipline

"Enlightened organizations employ a code of conduct necessitated by their craft discipline and their human relations discipline"

● FOR SOME TIME I've been noticing that the word "discipline" is being used in a different sense from the one I grew up with. I was used to thinking of it in connection with what happened to me in the woodshed with a strap when I'd been naughty or had been put in the hoosegow after being AWOL. It meant punishment imposed on a person by some one else for doing the wrong thing or for failing to do the right thing.

Although according to the dictionary the word "discipline" still may be used in that sense, I find it now is applied to the demand imposed by the basic principles underlying various branches of science or in the application of these principles to useful purposes.

Foundry Craft Discipline — It struck me that a great deal of unnecessary people trouble can be caused by a failure to tell the difference between these two brands of discipline. There can be little doubt that foundrymen, probably to a greater extent than the members of any other craft or profession, are forced to bend their wills to the despotic demands imposed upon them by the very nature of the metals and materials they use. Inevitable punishment follows sins of omission or commission against the impersonal discipline.

As we all know, metals have their own peculiar melting points with a very narrow range of pouring temperatures, regardless of personal opinions or hunches to the contrary. The temperatures demanded by these metals dictate the selection of the few refractories acceptable for lining the furnaces and ladles—also the fuel and heat supply — thus limiting free personal choice. The pressures developed by liquid metals

"I've told you time and again"

dictate a very narrow range of mold materials which will stand the gaff. And the shrinking characteristics inherent in the cooling metals issue edicts as to how the molds which enclose them are to be sprued, fed, gated, and risered.

So it would appear that these requirements, which are only a sample of many, indicate that freedom of personal choice of method and procedure in the foundry craft increases with ignorance and shrinks with knowledge and acceptance of the discipline.

Confusion about Discipline — There is little question in my mind that confusion between discipline imposed by the underlying principles of our craft and the seemingly arbitrary and personal demands of foundry bosses might be responsible for a large portion of our labor relations friction and difficulties. It is true that when orders or reprimands are issued, time will not always permit a full explanation of the philosophy behind the molten metal discipline and the difference between it and personal preference. An effort in that direction, however, certainly would pay dividends over the long haul.

Here's a case in point: "This is the last straw. I have taken all that I'm going to take. I've told you time and again. Now I'm through with you."

Four uses of "I" in a clump provide eloquent proof of the arbitrary punishment or chastisement type of discipline, seemingly with no reference to or connection with the craft discipline. What makes the difference between the previous four or five straws and the one that blew the old man's top? Was it something he ate or a dressing down from his own boss? This type of so-called discipline triggers labor relations difficulties.

In the kinder sense, there also is a discipline based on the principles underlying human behavior. I don't think we know much about it—or

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at least not as much as we do about the discipline of molten metals. But I'm sure we know enough to realize that even the humblest of us resists, and always will, being dictated to by another on an "I" basis.

Team Approach Needed — I am sure that I am not alone in the discovery that the most effective bosses, foremen, superintendents, and managers rarely use the word "I" when issuing orders, suggestions, or corrections. "We" most frequently is employed, and it's proper that such should be, for it deals with team activity, except, of course, in the Lee Hobby Foundry, which has only one employee.

Enlightened organizations I have known have agreed to a code of conduct necessitated by their craft discipline and by their human relations discipline through which each individual is informed and to which each individual must subscribe to be an active member of the team. All are subject to the code, regardless of job. Disciplinary measures are based on it and affect all.

Under these conditions, the use of the word "I" becomes silly. Nothing is perfect, of course, all of us being the way we are, but the kinder form of craft discipline takes precedent over the arbitrary, personal, and frequently biased punishment discipline.

Most of the outstandingly successful organizations I have come to know have spent a great deal of time and effort in the field of employee relations to formulate their codes of man-to-man relationships, with special emphasis on principles. But even greater effort is spent explaining and selling that the code is necessary to comply with unavoidable craft discipline. It's effort well spent.

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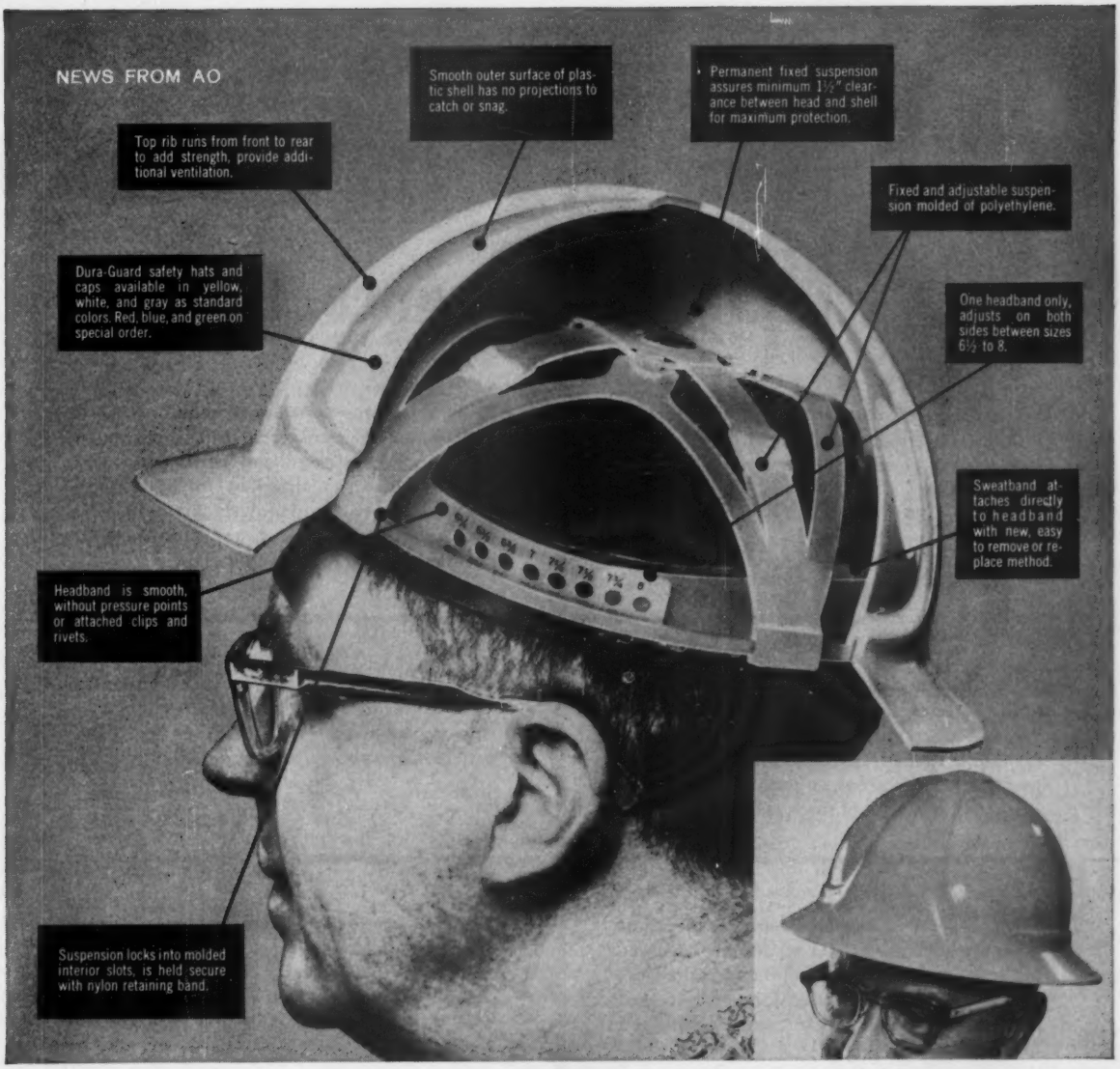
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NO. 8 is a powerful inoculant. It plants graphite *throughout* the molten metal. These "seeds" of graphite act as centers on which carbon dissolved in the molten metal may precipitate and grow as graphite while the casting is poured and the metal cools.

NO. 8 makes castings metallurgically more uniform. Photomicrographs show that iron treated with NO. 8 has a normal flake pattern throughout the section.

NO. 8 makes castings more machinable. With the addition of NO. 8, massive carbides are less likely to occur, and the metallurgical structure becomes more uniform from center to outside with a much better distributed graphite pattern.

NO. 8 is effective for special metallurgical control. For example, when iron is treated with NO. 8, an increase from 10 to 30% in deflection over the base iron value is usual. This means less cracked castings and greater yield.

NO. 8 reduces chill and hardness. For example, in untreated iron the Brinell hardness (wedge bar) was reduced from 229 to 217; total chill depth reduced from 41/32 in. to 13/32 in., and the clear chill from 26/32 in. to 10/32 in. with 1# of NO. 8 per ton of iron.

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Vacuum Spectrometer Aids

Gray Iron Foundry Control

All elements normally found in cast iron, including carbon, can be analyzed by this type of spectrometer

By E. L. ROTH and GEORGE ANTONIC
Motor Castings Co.
Milwaukee

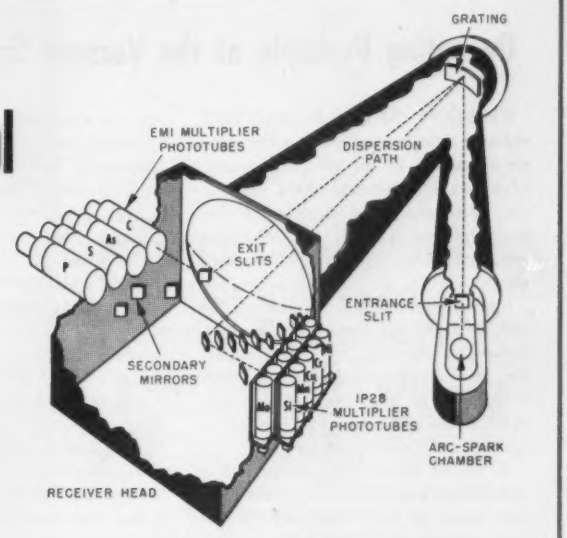


Fig. 1—Major components of a vacuum spectrometer

● CONTROL of all elements in cast iron was the objective when Motor Castings Co., Milwaukee, began evaluating a direct-reading vacuum spectrometer in May, 1960.

This instrument, called the Quantovac, is manufactured by Applied Research Laboratories Inc., Glendale, Calif. It will analyze all of the control and residual elements in iron, including carbon, sulfur, and phosphorus. Actually, it is a version of the Quantometer, also made by Applied Research Laboratories, but it operates under vacuum to enable determination of carbon, sulfur, and phosphorus. The most useful spectral lines for these elements are below 2000 A, or within the range where air absorbs emitted radiation.

Fig. 1 shows a layout of the vacuum spectrometer, with the end-on phototubes (left) for elements whose lines are below 2000 A and the side window phototubes (right) for the elements whose spectra are emitted above 2000 A.

Fig. 2 is a view of the Quantovac in our laboratory, showing the source unit, the spectrometer, and the recording console.

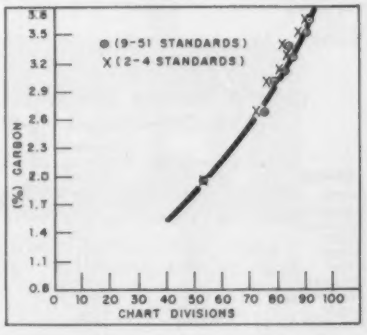
Constant Vacuum — The spectrometer is kept under a vacuum at all times, using a mechanical pump; only the arc-spark stand is opened to the atmosphere. Air is purged from the arc-spark stand with argon before each analysis. The purging and excitation cycle is automatic and consists of a 15-second period when the chamber is flushed with argon, followed by a 30-second pre-exposure period and a 25-second exposure period—a total of 70 seconds. Since all the elements are excited simultaneously, a single flushing and excitation cycle of 70 seconds provides us with a complete analysis.

Since 1957, when this instrument was first introduced, it has been used successfully to analyze those ferrous base metals in which carbon exists in a combined form, including residual and alloy steels, stainless steels, and tool steels. Its application to the analysis of cast iron depended on using test specimens in which all the carbon was combined and dispersed homogeneously. Thus, our initial requirement was to provide white iron specimens in which all the carbon was in combined form.

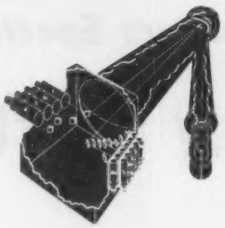
We were fortunate to obtain a set of chill cast iron specimens from the National Bureau of Standards. These samples will be issued as primary iron standards in early 1961. They were cast by a unidirectional

Fig. 2—Direct-reading vacuum spectrometer, as used by Motor Castings, consists of a source unit, the spectrometer, and a recording console

Fig. 3—Carbon reference curve was derived from data from two sets of chilled iron standards



Operating Principle of the Vacuum Spectrometer



EMISSION SPECTROMETERS evaluate light emitted when a test sample is excited by an arc-spark source. Direct-reading vacuum types, such as the Quantovac, are capable of determining quickly all the elements commonly found in cast iron or steel alloys.

Since other methods of analysis do not analyze all elements, especially carbon, or they are too time-consuming, the direct-reading vacuum spectrometer is an important tool for such applications as continuous control of melting in ferrous foundries.

In simple terms, a minute part of a sample is vaporized and excited to the point of light emission by an arc-spark source. This light is composed of characteristic spectral lines of specific wavelength for each contained element. Analysis is accomplished by dispersing the light into its components which then can be measured.

Fig. 1 shows the path of light through the spectrometer. First, it is dispersed by a grating which is a mirror with 30,000 grooves per inch etched on its surface. Light from each element is focused onto the proper photomultiplier tube by a system of mirrors. This electronic device transforms radiant energy into electrical energy and, at the same time, multiplies the generated current.

Current from each tube is fed into a separate condenser until an automatic switching device discharges one condenser after another, allowing current to flow to a chart recorder. Data recorded on the chart are referred to standard curves to obtain concentration figures of all elements present in the sample.

Major advantages of the instrument include 1) speed, good sensitivity, and close accuracy in making analyses, 2) low cost per analysis when 25 or more readings are made daily, and 3) ability to analyze for all elements commonly found in iron or steel.

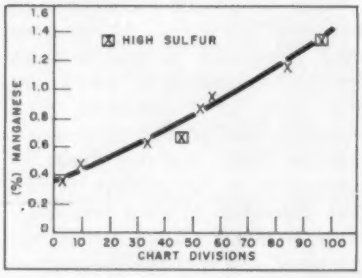


Fig. 4—Manganese curve. Chart divisions refer to data recorded on the unit's strip chart

chilling technique on a water-cooled copper plate and also were inoculated with bismuth and tellurium to enhance further a white iron structure.

These specimens were used in our initial evaluation and were found to be very homogeneous.

Fig. 3 is the curve for carbon. Two different sets of standards were run at different times and by different spectrographers. Both sets of values are shown on the curve and represent the extremes in the casting techniques for the 500 specimens of each composition that were prepared by the National Bureau of Standards.

Fig. 4 through 10 illustrate the curves that were obtained for manganese, phosphorus, sulfur, silicon, nickel, chromium, and molybdenum.

Concentration curves for copper, vanadium, and tin also were obtained, and the values fit on similar curves, even though the proposed standards cover wide ranges in composition.

Reproducible Analyses — Excitation conditions established with these proposed standards provide reproducible analyses as shown in Table I. These data are for 20 different determinations each on two of the NBS samples. Results from these determinations have been combined to illustrate our precision within the normal working ranges of the irons we produce.

Based on the excellent precision of the data from these unidirectional chill cast specimens, we decided to cast ladle samples in a similar

TABLE I—Precision Data on NBS Cast Iron Standards

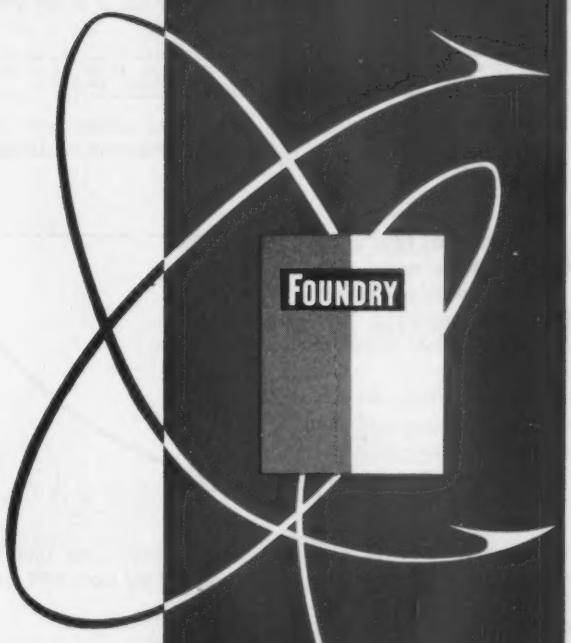
Element	Concentration, Per Cent	Standard Deviation, Per Cent	Coefficient of Variation, Per Cent
Carbon	3.00	0.020	0.66
Manganese	0.75	0.010	1.33
Phosphorus	0.06	0.0014	2.34
Sulfur	0.090	0.0016	1.77
Silicon	1.80	0.016	0.88
Silicon	3.10	0.038	1.22
Nickel	0.61	0.0045	0.73
Chromium	0.14	0.0035	2.50
Molybdenum	0.20	0.0064	3.20
Copper	1.00	0.01	1.00
Vanadium	0.074	0.0012	1.62

TABLE II—Precision Data on Routine Samples

Element	—White Chilled Sample— Concentration, Per Cent	Standard Deviation, Per Cent	—Gray Chilled Sample— Concentration, Per Cent	Standard Deviation, Per Cent
Carbon	3.37	0.040	3.22	0.20
Manganese	0.73	0.0087	0.55	0.012
Phosphorus	0.076	0.0019	0.068	0.0026
Sulfur	0.093	0.0019	0.109	0.0030
Silicon	1.88	0.021	1.79	0.012
Nickel	1.02	0.011	0.97	0.012
Chromium	0.32	0.005	0.28	0.006
Molybdenum	0.51	0.009	0.43	0.014
Copper	0.57	0.011	0.34	0.008
Vanadium	0.095	0.0012	0.085	0.0050

TABLE III—Precision Comparison of Base Iron with Tellurium Inoculation

Element	Concentration, Per Cent	Base Iron Standard Deviation, Per Cent	Base Iron with 0.035% Tellurium, Standard Deviation, Per Cent
Carbon	3.30	0.074	0.038
Manganese	0.58	0.016	0.016
Phosphorus	0.080	0.0025	0.0025
Sulfur	0.105	0.0029	0.0029
Silicon	2.28	0.039	0.039
Nickel	0.40	0.006	0.007
Chromium	0.15	0.006	0.006
Molybdenum	0.15	0.007	0.009
Copper	0.18	0.003	0.004
Vanadium	0.020	0.0007	0.0005



SPECIAL EDITORIAL REPORT

Meeting Competition Through Improved Foundry Technology

By taking advantage of latest developments in casting practice, foundrymen will be better able to capture a growing share of the highly competitive market for engineering materials.

To dramatize these developments, the editors of FOUNDRY will present another special report to the metal castings industries. This year's report will detail recent technical and operating advances of the industry, as applied to these metals: Gray Iron . . . Aluminum . . . Steel . . . Brass and Bronze . . . Malleable Iron . . . Magnesium . . . and Zinc. This important presentation will appear in the May 1961 . . . .

Pre-Convention Issue

It will be published just before the 65th Castings Congress of the American Foundrymen's Society in San Francisco, May 8-12.

Leading metal-casting authorities are preparing reports for this noteworthy editorial package. Progress and developments to be discussed, among other things, will be in the following areas of foundry practice: Casting design, casting cleaning, diecasting, melting methods and equipment, material handling, and sand technology as affected by molding and coremaking equipment and methods and new types of sand binders. Also, metals technology as affected by new alloys, heat treating methods and equipment, and melting methods and equipment.

In addition to these discussions, which will constitute an important contribution to foundry know-how . . . the May Pre-Convention issue will present program details on the Convention along with all the regular editorial departments.

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FOUNDRY

The Business Magazine of Metal Casting

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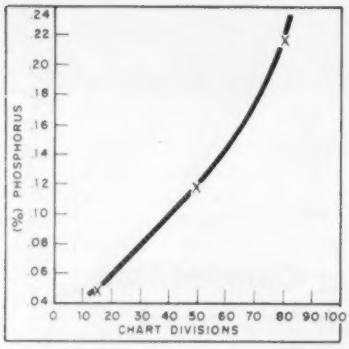

Fig. 5—Phosphorus must be determined in vacuum atmosphere

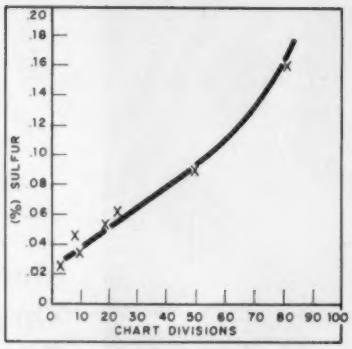

Fig. 6—Sulfur also requires a vacuum atmosphere for accuracy

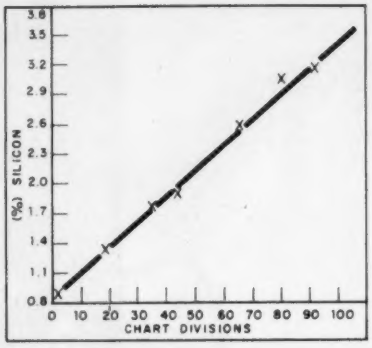

Fig. 7—As silicon plot shows, a wide range can be determined

manner. These samples were cast into a core sand mold on a water-cooled copper plate to provide a spectrographic disc that was 1¾ in. in diameter and ½ in. thick. These specimens were prepared for analysis by grinding the chilled surface to a 50-grit finish on a rotary disc grinder.

These test specimens must exhibit a white iron structure over the entire chilled surface and for a depth of at least ⅛ in. to obtain the correct carbon analysis. If the specimen surface is partially gray, the carbon analysis result will be higher than the correct analysis, and it will be variable. Table II shows a precision comparison of 20 determinations each on two alloy iron samples. It will be noted that only the carbon precision suffers appreciably in the specimen that is gray and that all other elements reproduce very well.

Base iron samples which do not contain appreciable amounts of the chill-enhancing elements—such as chromium, molybdenum, and/or vanadium—are more difficult to cast white with this technique than alloyed iron. Inoculation with bismuth or tellurium or a combination of both will provide white iron specimens. Table III shows the differences in reproducibility on 20 determinations on a base iron before and after tellurium inoculation. Again note that carbon is the only element in which the precision changes materially.

High Accuracy—The spectrometer was placed on full production control on Aug. 15, after numerous chemistry cross checks were made by two independent laboratories. It was obvious, after a short period of time, that the instrument was more accurate on a day-to-day basis than chemical analysis on all elements except carbon. After just a few days, the spectrometer was picking up glaring errors in the routine chemical results. Carbon results were not as accurate as the combustion determinations, due to the fact that not all the test specimens had been casting white. Typical variations in carbon on a day-to-day basis are shown in Table IV.

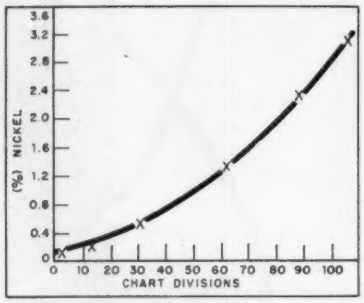

Fig. 8—Nickel plot and others were derived from NBS samples

The daily changes in our average deviations for carbon, as shown in Table IV, indicated that our unidirectional chill test was not providing us consistently with a test specimen that was white. We then designed a water-cooled permanent

TABLE IV—Comparison of Quantovac and Combustion Carbon Determinations Using Core Sand Mold

Heat Number	Daily Average Deviation, Per Cent (15-20 samples daily)
5894	0.054
5895	0.060
5896	0.083
5897	0.033
5898	0.097
5899	0.096
5900	0.066
5902	0.10
5904	0.068

Carbon range is from 3.00 to 3.50%

TABLE V—Comparison of Quantovac and Combustion Carbon Determinations Using Water-cooled Permanent Mold

Heat Number	Daily Average Deviation, Per Cent (15-20 samples daily)
5907	0.052
5908	0.044
5909	0.037
5910	0.040
5911	0.041
5912	0.045
5913	0.055
5914	0.047
5917	0.051
5918	0.047
5919	0.037
5920	0.033
5925	0.034
5927	0.047
5932	0.034

TABLE VI—Comparison Of Individual Carbon Analyses on Heat 5909

Tap Number	Per Cent Carbon (Quantovac)	Per Cent Carbon (Volumetric Combustion Determination with Induction Furnace)	Deviation
1	3.28	3.34	+0.06
5	3.11	3.18	+0.07
6	3.16	3.19	+0.03
9	3.23	3.23	0.00
12	3.24	3.22	−0.02
16	3.19	3.17	−0.02
22	3.09	3.14	+0.05
23	3.09	3.14	+0.05
25	3.15	3.11	−0.04
27	3.23	3.21	−0.02
35	3.33	3.30	−0.03
48	3.26	3.19	−0.07
58	3.41	3.40	−0.01
61	3.36	3.34	−0.02
69	3.34	3.32	−0.02
74	3.38	3.33	−0.05

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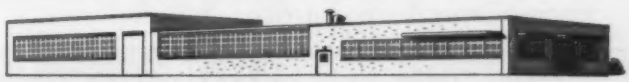

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Circle 628 on Page 39

Knight LETTER

FIFTH OF A SERIES

To: Foundry Management

Subject: Methods Analysis

What is the value for foundries to have an objective analysis made of their work methods by Knight Engineers?

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mold, patterned in part after a mold used by John Kelly of the Steel Co. of Canada. This is a split mold with copper inserts to chill the disc

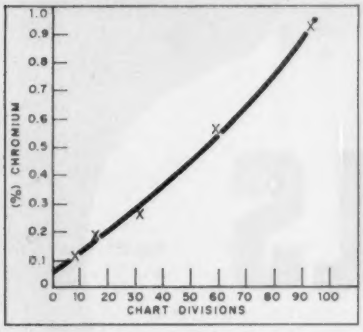

Fig. 9—Chromium plot has adequate range for normal irons

sample on both sides.

Test specimens cast into this mold were much more uniform in surface finish than those cast into the core sand mold. This means that we do less grinding to finish the specimen

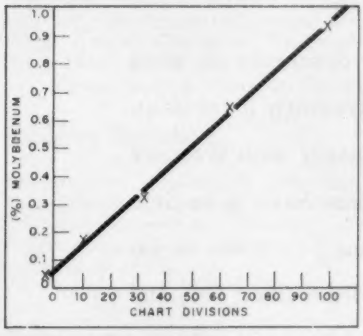

Fig. 10—Plot for molybdenum actually is a straight line

to the 50-grit finish for analysis. This mold has been used on the foundry floor for only a short period of time; however, it looks extremely promising.

Table V gives a comparison of the accuracy of the carbon determination using this mold. Table VI lists all data for the individual check analyses on carbon for heat No. 5909. It includes data for two different compositions of alloy iron and for base iron.

We wish to acknowledge the contributions to this work by Jim Slewitzke, who performed all the Quantovac analyses, and those of Frank Leedom and John Olle. We also very much appreciate the assistance of R. E. Michaelis of the National Bureau of Standards.

Editor's Note: This paper originally was presented at a meeting of the Gray Iron Research Institute Inc., Oct. 14, 1960, at Hartford, Conn.

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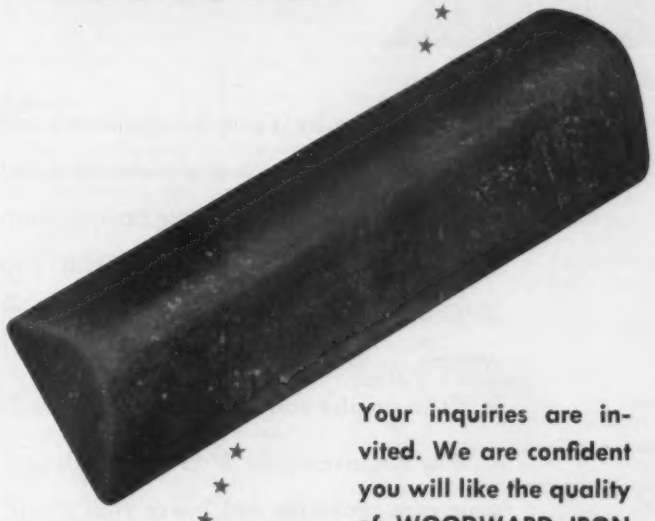

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LITERATURE for foundrymen

For More Information, Use Reader Service Card—Page 39

Ramming Mixes

Literature defines Magnaram 85 and 95 periclase ramming mixes for use in electric furnaces, open hearths, and ladles. Booklet covers screen and chemical analysis and shipping and installation data. —H. K. Porter Co. Inc., Refractories Div., Porter Bldg., Pittsburgh 19, Pa.

For More Details Circle No. 406—Page 39

Melting-Holding Furnace

Folder SEC-12 contains diagrams and specifications for an aluminum melting-holding furnace for use in permanent mold, sand, or diecasting plants. The bulletin also lists furnace advantages and design features. — Sunbeam Equipment Corp., 180-12 Mercer St., Meadville, Pa.

For More Details Circle No. 407—Page 39

Shielding Materials

New 36-page booklet contains details, drawings, and specifications concerning the installation of x-ray shielding material and other radiological protection. — Ameray Corp., X-Ray Protective Div., Kenvil, N. J.

For More Details Circle No. 408—Page 39

Maintenance Welding

Pocket-sized maintenance welding book includes new application and design data in 148 pages with illustrations.—Eutectic Welding Alloys Corp., 40-40 172nd St., Flushing 58, N. Y.

For More Details Circle No. 409—Page 39

Anti-Scoring Lubricant

Brochure contains information on an extreme pressure anti-scoring lubricant which is claimed to withstand 20 tons of pressure per square inch without breakdown.—Chicago Mfg. & Distributing Co., 1920 W. 46th St., Chicago 9, Ill.

For More Details Circle No. 410—Page 39

Blast Cleaning Equipment

Bulletin 227A contains diagrams and cut-away drawings of an impeller which uses controlled centrifugal force for its power. Booklet explains impeller's operation and construction.—Pangborn Corp., Hagerstown, Md.

For More Details Circle No. 411—Page 39

Material Handling Equipment

Booklet 2008-Q, "Engineering & Application Data," contains information on various types of carriers, cranes, tractors, track switches, and grabs. The booklet also offers studies of track design, peening, and stresses.—Cleveland Tramrail Div., Cleveland Crane & Engineering Co., Wickliffe, Ohio.

For More Details Circle No. 412—Page 39

Graphite Electrodes

Folder contains technical data sheets No. 1120, 1135, 1150, 1165, 1180, 1195, 1210, 1225, 1240, and 1255, which list physical properties of electrodes in sizes from 3 in. and smaller to 45 in.—Great Lakes Carbon Corp., Electrode Div., 18 E. 48th St., New York 17, N. Y.

For More Details Circle No. 413—Page 39

Air Filters

Bulletin 208 lists the advantages of Foamat filters, which come in three sizes to permit capacities as high as 1800 cfm per cell. Engineering and performance data are included.—American Air Filter Co., Louisville, Ky.

For More Details Circle No. 414—Page 39

Vibrating Conveyors

Catalog 66 illustrates and describes open and closed pan vibrating conveyors. Flow charts show adaptability of units for various jobs.—Ajax Flexible Coupling Co., Inc., Westfield, N. Y.

For More Details Circle No. 415—Page 39

Fork Lift Trucks

BU-638 covers safety diesel fork lift trucks in capacities from 3000 to 8000 lb and lists their advantages.—Allis-Chalmers Mfg. Co., Engine-Material Handling Div., Milwaukee 1, Wis.

For More Details Circle No. 416—Page 39

Did You Miss These?

Here is a list of popular literature items offered in recent months:

RELEASE AGENT (Bulletin M-32)—Witco Chemical Co., New York 17, N. Y. Circle 402, Page 39.

METALLURGICAL SERVICES — Charles C. Kawin Co., Chicago 5, Ill. Circle 403, Page 39.

EXOTHERMIC PRODUCTS—Pittsburgh Metals Purifying Co., Mars, Pa. Circle 404, Page 39.

PARTING COMPOUNDS (Catalog 500)—Hill & Griffith Co., Cincinnati, Ohio. Circle 405, Page 39.

Pyrometer

Brochure gives complete details on two-color pyrometer. It lists general specifications on standard models, special features, typical applications, and photographs of sensing head and control units.—Shaw Instrument Corp., 1001 Lloyd Ave., Latrobe, Pa.

For More Details Circle No. 417—Page 39

Bucket Conveyor

Catalog HB-1000 illustrates and describes bucket conveyors. The catalog gives carrying capacities at 45, 75, and 90-degree angles and shows typical bucket conveyor circuits.—Conveyor Corp., 19815 E. Nine Mile Rd., St. Clair Shores, Mich.

For More Details Circle No. 418—Page 39

Amplifier-Analyzer

Literature describes model 250 amplifier-analyzer, which has a resolving time of less than 1.5 microseconds. Included are specifications and a price list.—Baird-Atomic Inc., 33 University Rd., Cambridge 38, Mass.

For More Details Circle No. 419—Page 39

Battery Chargers

Bulletin BC-60-1 describes automatic battery chargers equipped with magnetic amplifier control. Units are available in variety of cabinet styles for indoor and outdoor use.—Christie Electric Corp., Dept. C., 3410 W. 67th St., Los Angeles 43, Calif.

For More Details Circle No. 420—Page 39

Abrasive Belt Machine

November issue of *The Abrasive Workshop* shows how abrasive belt machine can grind diecast aluminum parts to close tolerances of flatness, thickness, and parallelism. — Carborundum Co., Niagara Falls, N. Y.

For More Details Circle No. 421—Page 39

Belt Conveyors

Bulletin 300 discusses the applications and advantages of portable belt conveyors. Three types of portable conveyors are illustrated: Lightweight aluminum, general duty, and heavy duty. Specifications are included.—Rapids-Standard Co. Inc., 342 Rapistan Bldg., Grand Rapids, Mich.

For More Details Circle No. 422—Page 39

Aluminum Ingot

Brochure titled "Aluminum Casting Alloy Ingot," presents revised terminology,

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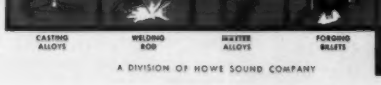

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text, and tabulated information on company's methods of production of aluminum ingot. Booklet includes thermal treatment chart, illustrations, and sales composition limit charts.—**Aluminum Co. of America**, 767 Alcoa Bldg., Pittsburgh 19, Pa.

For More Details Circle No. 423—Page 39

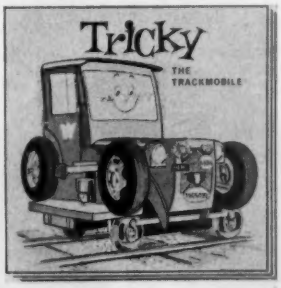
Midget Air Cylinders

Bulletin 0230-B1 provides engineering data and specifications on 200-psi midget air cylinders. The booklet describes both universal and nose mounting models in ¾, 1, and 1⅛-in. bore sizes with standard strokes to 12 in.—**Hannifin Co.**, Dept. 238, 501 S. Wolf Rd., Des Plaines, Ill.

For More Details Circle No. 424—Page 39

Material Handling Equipment

Book entitled "Tricky the Trackmobile" describes a vehicle for use in handling



materials either on rails or roads.—**Whiting Corp.**, Harvey, Ill.

For More Details Circle No. 425—Page 39

Recorders and Indicators

Catalog C15-1a illustrates and describes all models of firm's recorders and indicators. It also contains specifications for all models, scale ranges of the charts, dimensions, and ordering information.—**Minneapolis-Honeywell Regulator Co.**, Wayne & Windrim Avenues, Philadelphia 44, Pa.

For More Details Circle No. 426—Page 39

Furnace Equipment

Bulletin SEC-11 illustrates industrial furnace equipment for heat processing. It includes a guide for selecting proper equipment for particular heat processing requirements.—**Sunbeam Equipment Corp.**, 180-11 Mercer St., Meadville, Pa.

For More Details Circle No. 427—Page 39

Hardness Tester

Catalog RT-60 describes hardness and microhardness testers and explains the principles of hardness tests and microhardness testing. It contains illustrations and diagrams of various models and accessories.—**American Chain & Cable Co.**, Wilson Mechanical Instrument Div., 230 Park Ave., New York 17, N. Y.

For More Details Circle No. 428—Page 39

Stainless Steels

Technical report discusses in detail the heat treating variables of hardenable stainless steels with chemistries suitable for investment casting. Report presents test bar results, transformation behavior, and the effects of chemistry of these steels.—**WaiMet Alloys Co.**, 5320 Oakman Blvd., Dearborn 2, Mich.

For More Details Circle No. 429—Page 39

Fork Lift Truck

Bulletin SS-487 contains technical data and scale drawings showing dimensions and turning radius of fork truck Model 8024, an 8000-lb capacity battery-powered unit.—**Clark Equipment Co., Industrial Truck Div.**, Battle Creek, Mich.

For More Details Circle No. 430—Page 39

Automatic Controls

Bulletin MSA-189 discusses how automatic controls can be applied to older furnaces. Adaptation of automatic control systems to 12 open hearth furnaces is described in case history form.—**Hagan Chemicals & Controls Inc.**, Hagan Center, Pittsburgh 30, Pa.

For More Details Circle No. 431—Page 39

Vertical Conveyor

Bulletin 125 explains the operation of company's continuous vertical conveyor. Diagrams show various installations for moving material from floor to floor.—**Standard Conveyor Co.**, North St. Paul 9, Minn.

For More Details Circle No. 432—Page 39

Dust Collectors

Folder illustrates and describes various styles of dust bags and explains the advantages of each type. The folder also contains a table of fabric properties and conditions which each fabric will withstand.—**National Filter Media Corp.**, 1717 Dixwell Ave., New Haven 14, Conn.

For More Details Circle No. 433—Page 39

Safety Equipment

Catalog S-37 features 57 eye and face protection products and accessories. It

includes information on lenses, replacement parts, and goggle cases.—**Sellstrom Mfg. Co.**, Palatine, Ill.

For More Details Circle No. 434—Page 39

Fireclay Refractories

Brochure reviews company's principal brands of refractories and lists specific brands for medium, high, and superduty service. It gives property descriptions, panel spalling test, and load test results.—**Harbison-Walker Refractories Co.**, Pittsburgh 22, Pa.

For More Details Circle No. 435—Page 39

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Circle 633 on Page 39

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Castings Demand Turns Upward in Midwest

CHICAGO—Some foundries in this district are encouraged by the volume of castings orders they are getting. For this group, January proved to be a better month than expected and February appeared certain to hold or extend the gain. Operations averaged 32 to 40 hours a week, with a few shops hitting 44 hours.

But, about as many foundries as racked up improved business reported a standoff or declining demand in January and February. For many of these shops, the opening months of the year normally are slow for seasonal reasons.

Inquiries Encouraging—It is generally agreed, however, the volume of inquiries for castings is pretty good and this in itself is encouraging. Since buyers of castings are cost conscious and out to get the lowest possible prices, the volume of inquiries may be misleading as a guide to future business. The same inquiry may have been sent to a number of shops.

The reason individual foundry operations lack uniformity seems to be the wide variations in the business levels in the industrial and consumer goods fields which the foundries serve. A number of segments of the economy which are big users of castings have been slack. Present consensus of business forecasters is that the upturn will come in April and May.

Signs of Life—Farm machinery already is enjoying a mild upswing, and it should continue. A similar situation exists in household appliances, with the exception of refrigerators. There is a good upward push in laundry equipment. Automobiles, which have been suffering from heavy inventories and poor sales weather in most parts of the country, should show substantial improvement in second quarter. Because of reduced car loadings and a financial pinch, the railroads are not likely to provide a good equipment market before late in the year.

The outlook in construction is particularly encouraging. A record volume of work is on books and its impact will be felt with a break in the weather. Housing starts are expected to increase about 6 per cent this year to an annual rate of 1.3 million units. There will be more government influence in housing this year because of the industry's potential role as a business stimulant.

Diecasters Plan Clinic in Cleveland

CLEVELAND—A large-scale diecasting clinic will be held some time in April at the Carter Hotel, Cleveland, by Cleveland Chapter, Society of Die Casting Engineers. From 35 to 40 diecasting producers are expected to participate in the application clinic, the first of its kind in the area.

There will not be elaborate booths or displays. Each participating company will have an area set aside where potential diecasting users can discuss production techniques, design features, and cost factors with engineering personnel of the diecasters. Admission to the clinic will be free to all potential diecasting users in Ohio and surrounding areas.

New England Activity Disappointing

BOSTON—Although some improvement in demand for iron castings is likely to develop during March, first quarter volume will be disappointing—30 to 40 per cent under last year's.

The decline in malleable tonnage also was pronounced until recently when some spotty recovery appeared.

Nonferrous shops expect a pickup this spring, one factor being a prospective improvement in shipyard requirements. Inventories of both producers and consumers of brass and bronze castings are low.

Demand for electrical machinery is holding better than that for most other types of industrial equipment. Machine tool business is moderately heavier but spotty, and castings needs for papermaking, textile, and other machinery items is in a similar situation. Demand for diecasting and plastic injection machines is steadier.

With stock of castings consumers low, foundries are being pressed for prompt delivery. To meet such demands, some iron foundries are operating three to five days a week but with small crews. In certain instances larger users of brass castings want less than 1-week delivery.

There is some tendency for machine tool builders to get out of the foundry business. Within the last year a Greenfield, Mass., tool company closed its foundry affiliate and now buys castings from a larger shop having more extensive machining facilities.

Pittsburgh Steel Foundries Lag

PITTSBURGH—Contrary to expectations, foundry business didn't pick up in January. It got worse, and at leading steel foundries, there's little optimism for February or March. Shipments have dropped and sales have skidded to the depressed levels of last summer.

The plight of one firm, as outlined by its sales chief, is typical: "About 30 per cent of our business is with the railroads; they're not buying because carloadings and revenues are off. Steel mills, our next biggest customers, don't want

to order anything because they're operating at less than 50 per cent of capacity. Their requirements for maintenance and repair work are less than normal and, since their budgets have been cut, they're trying to get by with minimum inventories."

Backlogs at most foundries are practically nil. There's no justification for operating more than two or three days a week, but some companies find that they have to run five days to meet customer demands for fast service.

Although business has seldom been slower, the price situation doesn't seem to be getting any worse. The attitude of most foundrymen is that there's no point in taking a job on which they can't at least meet overhead expenses. Foundries supplying railroad car builders raised their prices 5 per cent on Jan. 1, reinstating a schedule that was originally published in November, 1959. The increase didn't stick then, but most observers believe that it will stand up this time.

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500 LB.	1000 LB.	2000 LB.
Time: 30 min.	Time: 40 min.	Time: 45 min.
Oil Used: 11½ gals.	Oil Used: 19 gals.	Oil Used: 40 gals.
*Gas Used: 1400 cu. ft.	*Gas Used: 2800 cu. ft.	*Gas Used: 5250 cu. ft.

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In most cases, gray iron and nonferrous foundries are doing no better than those that specialize in steel castings. Larger firms that limit themselves to long production runs haven't been hit as hard as the job shops, but they've had to cut their operations to three days a week.

Harmful as the recession may be to some foundries, it's affording others an opportunity to install new equipment without disrupting daily operations. Captive foundries and large independents are putting in mechanized molding lines and investing heavily in high-production, automated equipment.

Pickup Anticipated in the East

PHILADELPHIA — Approach of spring has developed better sentiment among foundrymen, but so far has not resulted in an appreciably better order book.

Most gray iron job shops still are limping along, operating about three days a week with small backlogs. Producers of malleable, steel, and nonferrous castings are in much the same situation.

The feeling persists, however, that improvement is "just around the corner." Consumer stocks of castings are low. Construction requirements should become more active as the weather improves.

Gray iron producers say that machine tool requirements are very slow, although casting demand for textile and papermaking machinery is fairly well sustained, and there is a moderate improvement in electrical equipment specifications.

Demand for steel castings is spotty, reflecting particularly the lag in industrial equipment. There is, however, some stepping up in ship work. Most shops are running three to four days a week with limited working forces.

Malleable producers are stocking pipe fittings in the expectation of a gradual improvement in orders. Also, they are a bit more optimistic over the outlook for building hardware. Prospects for boat fixtures and electrical components are looking up. Malleable shops are averaging three to four days a week.

Nonferrous business remains sluggish. In red metal, most job and captive shops are operating two to three days a week. Aluminum casting producers are faring somewhat better.

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HEALTH STUDIES

Of Shell Molding

By G. E. TUBICH, I. H. DAVIS, and B. D. BLOOMFIELD
Michigan Department of Health
Lansing, Mich.

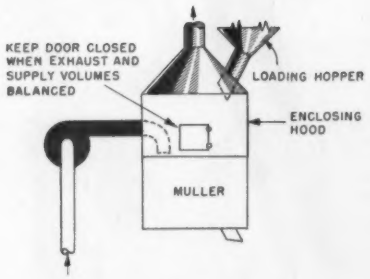


Fig. 1—Muller for mixing resin with the sand has this ventilation system to control dust

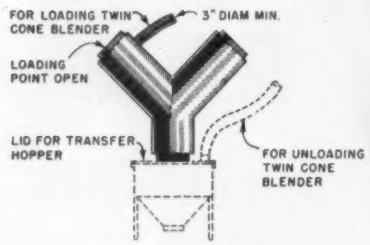


Fig. 2—Flexible takeoff ducts take away dust during loading and unloading of the blender

● SHELL MOLDING and shell coremaking have proved to be valuable foundry processes. Hazards inherent in these processes, however, must be controlled or at least minimized to provide worker safety and comfort.

One hazard is dust concentration in the atmosphere. Contrary to popular belief, shell molding does not reduce dust concentrations in the foundry. Instead, studies[1] have shown that free silica content and particle size of molding materials and airborne dust are similar in both shell molding and conventional foundry operations. Silicosis risk from shell molding operations is no different from the risk in conventional foundry operations.

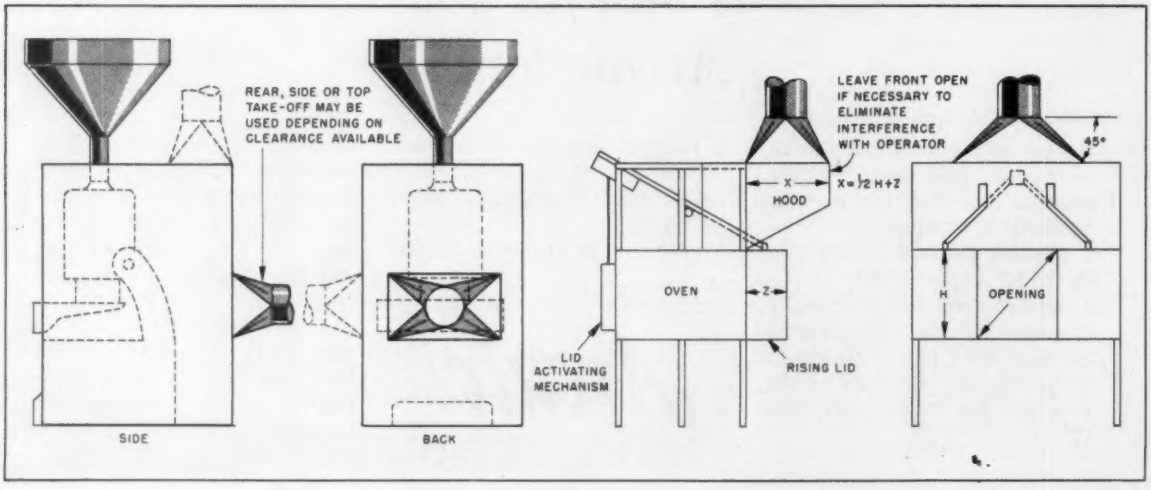
The high concentration of combustible resin at sand conditioning by the dry blending method indicates a potential dust explosion hazard. Settled dust caused a dust explosion in one of the plants studied. Maintenance men working overhead disturbed a 3-year accumulation of resin-sand dust on the rafters. The dust cloud was ignited by the gas flame in the shell-curing ovens. Removal of this accumulated dust by vacuum is recommended strongly.

The phenol formaldehyde resins generally used in shell molding can cause a skin disease called dermatitis. Not all workers are susceptible to this ailment; in fact, studies[2] have set the dermatitis incidence ratio at one person in six among those exposed to shell molding resins. This number can be reduced, however, if proper measures are taken.

Additional health hazards result from the use of toxic solvents, formation of carbon monoxide during pouring, and decomposition of the resins into products irritating to the human system. Again, the hazards can be controlled or min-

Fig. 3—Two views show various positions for ducts on ventilating system for a shell molding machine

Fig. 4—A canopy-type hood is recommended for proper ventilation of a shell mold curing oven



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BEAR Abrasives

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(Guard has been removed from machine for photo.)

imized if proper measures are taken.

Minimizing Health Hazards

General recommendations are as follows:

1. Provide local exhaust ventilation for sand conditioning, shell molding, shell curing, gluing, pouring, and shakeout.
2. Provide local exhaust ventilation based on solvent-vapor control at sand conditioning where alcohol-resin mixtures are employed.
3. Select a safe diluent for silicone parting compounds.
4. Provide good housekeeping to prevent accumulation of combustible dust.
5. Control dermatitis as follows: a. All workers, particularly those in contact with powdered or liquid resins, should be provided readily accessible washing facilities and practice strict personal hygiene. b. Effective ventilation systems should be provided to minimize skin contact with resin dust and vapors at all operations. c. Protection devices, such as cotton gloves and sleeves, are satisfactory for reducing skin contact with the resin and resin vapors. The face and neck can be protected further with water-repellent barrier creams. d. Workmen with active dermatitis should be removed from resin exposure and referred to a physician for treatment. After complete recovery these men may be reassigned to the area, providing proper protective devices are utilized. They then should be observed carefully for sensitivity reactions and should be removed immediately when indications of this reaction exist.

Ventilation Control—The following comments on ventilation control measures for shell molding are specific to those operations not common to conventional foundry practice. Reference is made to the Industrial Ventilation Manual[3] published by the American Conference of Governmental Industrial Hygienists, for detailed design information pertaining to ventilation control of foundry operations in general.

Resin-Sand Preparation — Intermixing of the resin with sand is accomplished in conventional foundry sand mullers, cone blenders, and rotating drum-type mixers. Resin preparations are added either as dry powder, coarsely ground, or in solution form where alcohol usually is the solvent. Water-soluble resins also are in limited use.

Depending on the type of resin introduced into the mixing unit, the contaminants emitted which necessitate proper control are silica dust, resin dust, and alcohol vapor. The last is simply a solvent carrier which is evaporated during the resin-sand mixing process.

Muller—The conventional foundry sand muller commonly is used for resin-sand mixing and is suited to dry-blending procedures. Satisfactory dust control can be provided at the muller by local exhaust ventilation as shown in Fig. 1.

Twin-Cone Blender—During operation, the twin-cone blender apparatus rotates, and when it is properly sealed there is no dust emission problem. Considerable difficulty is encountered, however, during loading of the blender, usually from a skip hoist into a top opening, and during unloading of the blender into a transfer hopper.

As shown in Fig. 2, it is necessary that during loading a flexible takeoff duct be connected to the blender at the loading point and that during unloading a similar flexible takeoff duct be connected to the covered transfer hopper to pick up displaced air. Unless these precautions are taken, a severe dust problem develops.

Rotary Drum Blenders—The rotary drum blender (closed ends) can present a problem if not properly sealed, and serves as a dust emission source during loading and unloading. Material transfer points require appropriate ventilation. The open-end rotary blender requires ventilation control during blending, loading, and unloading. Locally exhausted enclosing - type booths can be applied to either of these rotating units satisfactorily.

Cold Coating—The special problem in this process involves sand drying. When alcohol or similar solvents are used, it is necessary that the solvent be driven off and the molding sand unloaded in a dry, thoroughly mixed state. When a water-emulsion is used, moisture instead of the inflammable solvent necessarily is driven off, and here again the criterion of a satisfactory blending is a dry, thoroughly mixed product. The alcohol used in cold

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coating is driven off by the hot air passed into the muller during the average 10-minute mulling period, with most of the alcohol vaporized and emitted during the second and third minutes of the cycle.

Exhaust volume from the muller is based on the supply air flow rate. The basic design criterion is to supply a sufficient amount of air to the muller so as to keep the alcohol-air concentration to a level which does not exceed 25 per cent of the lower explosive limit. For design purposes it is satisfactory to assume that almost all of the alcohol used in the mix is evaporated within a 2-min. period and further to limit the heat input so as to prevent the resin-sand mix from exceeding a temperature of 200° F.

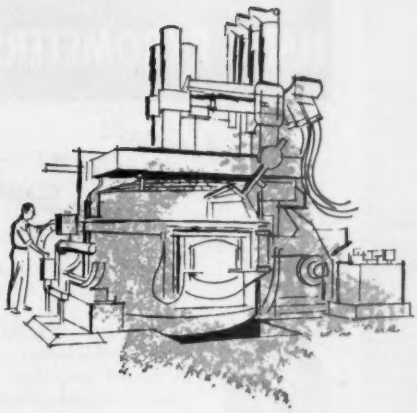
When a water emulsion is used, the supply air volume is based on the amount of moisture to be driven off and the degree of dryness to be attained. Again the maximum resin-sand mix temperature factor (heat input) should be considered so as to prevent any polymerization within the mixing unit.

Hot Coating — Local exhaust ventilation for this mixing process, which conventionally is done in a muller, is illustrated in Fig. 1. As in the cold-coating process, the exhaust volume is based on the amount of heated air supplied, but since no supply air dilution factor is involved, the volume exhausted is considerably less.

Molding—The molding machine is essentially a mechanized dump box and is a dust-emission source by virtue of the several material transfer locations built into it. The operation is dusty, and the heat of the pattern causes the emission of monomers and decomposition products.

Local exhaust ventilation to maintain control of the contaminants given off is applied best in the form of an enclosing-type booth with only one face opening, as illustrated in Fig. 3. The ventilation takeoff can be located at the top or the rear or the sides of the enclosing hood, depending on method of operation and clearances available.

Curing—The molded shell section is rotated automatically into an adjacent oven where the resin binder is polymerized. Resin components, such as phenol and for-



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maldehyde and other resin decomposition products, are given off during the cycle and are particularly apparent when the cured shell section is swung out of the oven. The gas emission is readily visible.

Fig. 4 illustrates a canopy-type hood which can be applied successfully to the oven to control the contaminant given off. The design volume should include a product of combustion factor.

Gluing — Originally done with spring clips or clamps, the joining of cope and drag now involves a simple gluing procedure, utilizing

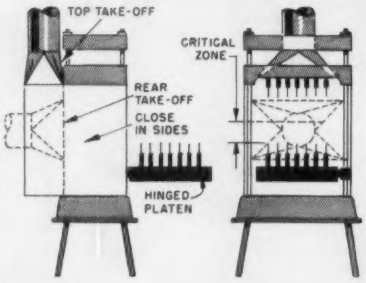

Fig. 5—Gluing machine should have ventilation control such as this side-draft hood

a resin adhesive which is cured under low pressure. Fig. 5 illustrates a gluing machine to which ventilation control is applied in the form of a side-draft hood.

Basic ventilation design consists of enclosing the machine on the back, the two sides, and the top and utilizing the rear or top exhaust takeoff. During curing a considerable amount of decomposition products is given off, and, unless ventilation control is maintained, the presence of irritable decomposition products is easily detected.

Shell Coremaking—This process is finding increased use. Both particulate and gaseous contaminants are released in significant quantities, and local exhaust ventilation is required for control. The machines observed to date readily can be enclosed within a small hood similar to that used for shell gluing, as illustrated in Fig. 5. The design exhaust volume also is the same—150 cfm per square foot of hood face opening.

Other Operations—The reader is referred to the Industrial Ventilation Manual[3] for information concerning ventilation control to be

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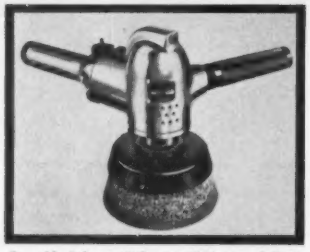

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applied to those foundry operations not discussed in detail. With the exception of a reduced amount of sand handled and those operations specific to the making of the shell molds, there is no disparity between the shell molding process and other procedures which are used in foundry operations.

Make-Up Air—It is necessary that a volume of tempered make-up air equal to the volume exhausted from the shell molding plant be supplied to eliminate the negative pressure condition which otherwise would develop.

Having a negative pressure results in cold drafts of air entering through building openings during cold weather, causing worker discomfort, upsetting the ventilation control measures, and making the plant impossible to heat evenly. Provision of tempered make-up air should be considered an integral part of the ventilation control system.

Air-Cleaning Equipment — Although it is necessary that the contaminants given off at the various shell molding processes be exhausted from the workroom, it would not do to exhaust them directly to the outside, thereby creating a neighborhood air-pollution problem. Properly designed air - cleaning equipment should be applied to both particulate materials and fumes as a means of recovering the contaminants.

A fabric filter is well suited to the dust-producing operations in the shell molding plant, and both dry and wet centrifugal collection equipment also are applicable. Wet, fabric, and electrostatic precipitation type collectors can be applied successfully to most types of melting operations.

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Editor's Note: This report, presented with the permission of the American Medical Association, is taken from an article, "Occupational Health Studies of the Shell Molding Process," published in the May, 1960, issue of the *A.M.A. Archives of Industrial Health*. Copies of the complete paper can be obtained from George E. Tubich, Michigan Department of Health, City Hall Annex, Grand Rapids 2, Mich.

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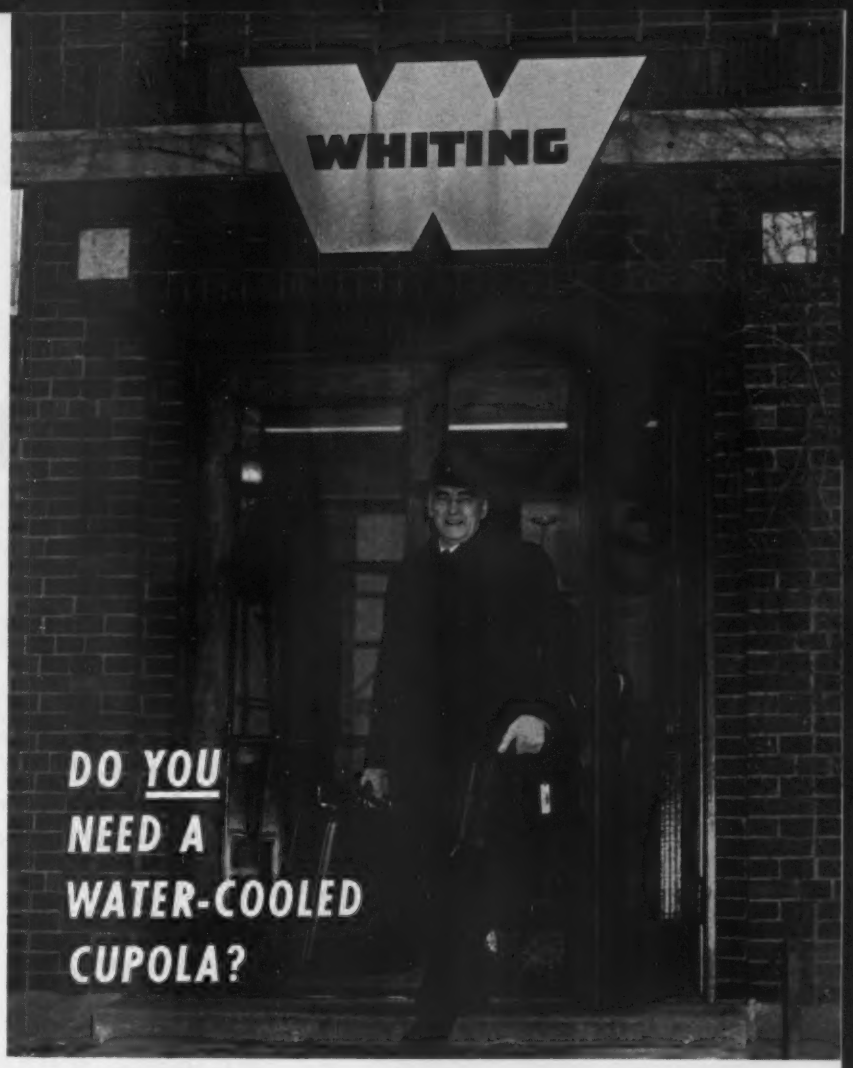

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Cutting Metal Costs

. . . of Nonferrous Castings

Proper metal preparation is basic to production of good castings. This article describes some common problems and their solutions and suggests how to cut costs for aluminum and copper-base alloys

● MANY scrapped castings can be attributed to the metal from which they are poured. Even when a good pattern is used with correct molding practice, improper preparation of the metal, by either the smelter or the foundry, can promote a costly scrap rate.

Too often, materials are purchased on lowest bid basis when other more expensive materials would provide certain advantages. Actually, the ultimate cost of using a metal to make castings is more important than its initial price.

Most foundries, realizing the trouble, expense, and hazards of producing their own alloys, purchase prealloyed ingots. Since ingot production is governed by analysis, chemical specifications have become the standard criterion by which all ingots are bought and sold. However, these specifications do not indicate relative proportions of oxides, dross, slag, etc., that are present. These impurities vary in similar alloy ingots from different sources and can result in various problems.

Melting Loss—One difficulty is high melting loss which may occur when impurities float or are fluxed away during the casting process. Inferior mechanical properties will result from the presence of inclusions not fluxed out of the metal before it is cast. Also, pressure tightness may be difficult to obtain, especially in thin sections, due to lack of homogeneity.

For these reasons, casters should always consider their sources of supply and make sure that correct techniques are being employed for producing basic metal so that the metal itself does not cause the scrap. But the metal caster also must be ready to examine his own operation for factors that are causing scrap.

Aluminum Alloys — At every stage of melting, alloying, and pouring aluminum alloys, care must be taken to prevent the formation and incorporation of oxides into the metal. Thus the skin of the top surface of a ladle of molten aluminum or a just-poured ingot should be skimmed off.

In the manufacture of high-magnesium alloys, beryllium is added as a catalytic agent for maximum solution recovery of magnesium. Due to the extreme reactivity of magnesium, however, it forms black oxide specks which form pockmarks on both ingots and castings. Through a slight but effective use of chlorine, these undesirables can be coagulated on the surface and removed with just a slight loss of magnesium.

In high-silicon alloys, for best mechanical properties the magnesium content must be kept at a minimum (below 0.10 per cent). Vice-versa is true for high-magnesium alloys; the presence of silicon impurity is extremely detrimental to highest mechanical properties and should be maintained as much below 0.30 per cent as possible.

Aluminum alloys high in manganese, iron, titanium, chromium, etc., tend to form sludge at lower temperatures. For this reason, molten metal should be hot enough before castings are poured. In the opinion of some foundrymen, a slight degree of super-heating before casting ingots will tend to decrease the observed sludging characteristics.

Even though the surface finish of castings of the same alloy is similar, a finer finish may be obtained by adding grain refiners (e.g. 0.20 per cent titanium) where specifications permit their use. Melting and pouring temperatures maintained at their correct levels also will help.

The effect of trace elements like titanium, boron, or zirconium add-

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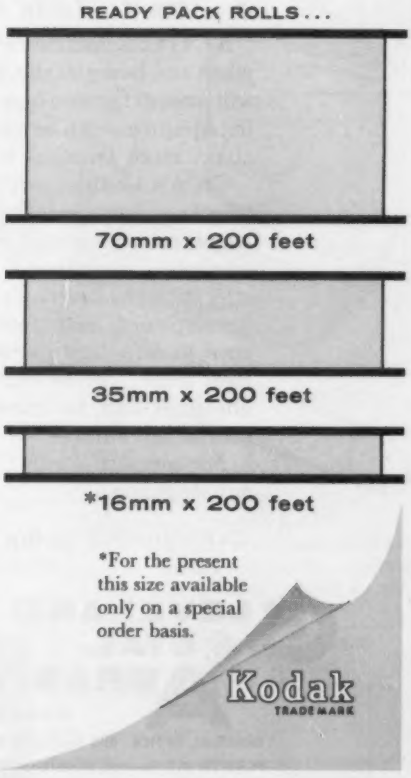
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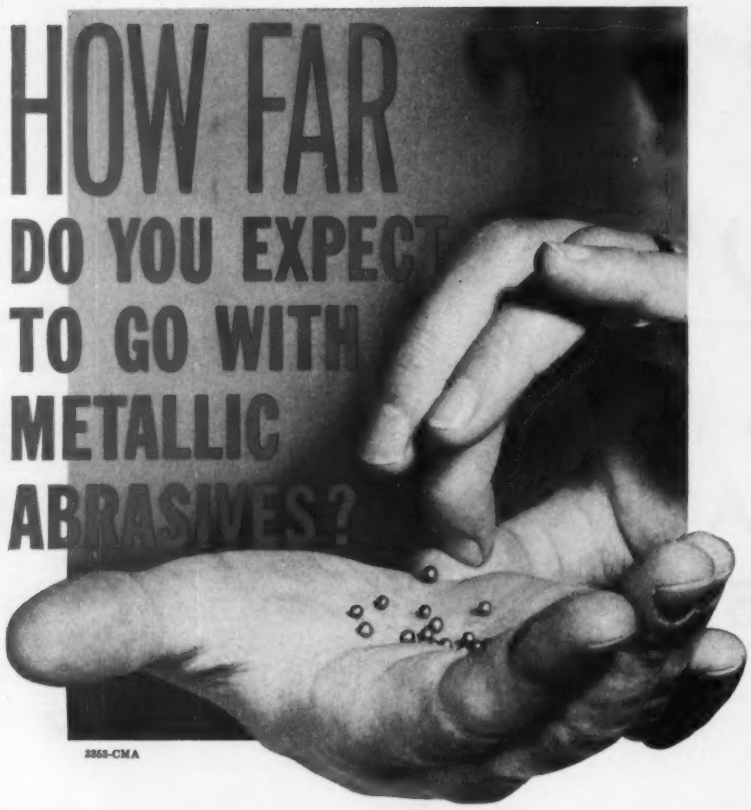

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ed for grain refinement, or modifiers like sodium for eutectic and hypoeutectic, and phosphorus for hypereutectic aluminum-silicon alloys, often is eliminated by remelting or heating to excessive temperatures. Their presence, though unessential to ingots, often is of paramount importance in castings.

Trace elements which are injurious to an alloy are termed impurities. Iron is such an element. In high-strength alloys where elongation is important, it is generally maintained below 0.50 per cent.

Copper-Base Alloys—Sulfur has a deleterious effect on brasses and bronzes. Its effect is especially harmful on the higher nickel copper-base alloys, where it causes intergranular attack. Its sources therefore must be eliminated in the following ways:

1. The fuel oil used in the open-hearth or rotary type furnaces can contain considerable amounts of sulfur. This must be checked and controlled through an initial purchasing agreement. 2. If gas is used as a fuel, the SO_2 content must be checked (this is usually low). 3. In investment castings, the $CaSO_4$ used as the molding material also can cause trouble if sufficient amounts of it adhere to the returns. After insuring that its presence is at a minimum, further amounts of sulfur can be counteracted by use of a suitable flux like Na_2CO_3.

In the silicon and aluminum bronzes, gassing frequently is used because oxidizing atmospheres or fluxes cannot be employed since they tend to remove some of the important constituent elements such as aluminum, iron, or silicon. For this reason dry, oil-pumped nitrogen should be used to flush out the nascent hydrogen in the molten metal.

Presence of hard spots, a subject of concern for many foundrymen, can be quite acute since a percentage of them can be transmitted from the ingot to the casting. Incorrect introduction of iron into the alloy usually causes this trouble. Use of master alloys for adding iron can help, but if hard spots already are present in the base metal, they will show up in the casting. Best means to eliminate hard spots is to insure perfect solution of the iron constituent.

This can be achieved best in pure metals, as opposed to alloys, where the presence of other elements already has reduced the solubility of the base metal.

Copper-Base Slags—During the alloying of metal, fluxes are used to form a protective covering to minimize loss of volatile elements, prevent oxidation, and decrease the absorption of moisture and gases. In addition, fluxes should be used to control the amounts of undesirable impurities by adjusting the pH of the resultant slag. Glass forms a thin neutral cover, and sand thickens the slag and is slightly acidic in nature. Limestone is used to form a basic slag.

Slag contains oxides plus a certain percentage of metal. It is the normal tendency for smelters to try to work as much metal from the slag back into the parent metal. There is a certain limit, however, beyond which the oxide inclusions tend to dissolve into the metal. Before this point is reached, the slag should be removed even though it contains some metal.

When a thin slag cover is left on the metal surface before pouring, it tends to flow into the mold along with the molten metal. In the case of castings, slag mars the surface appearance or results in inclusions. In the case of ingots, it causes a low metal recovery if adequate fluxing is employed during melting. Thus, the slag must be removed in both the furnace and pouring ladle.

Use of correct fluxes and atmospheres is important. With the high-copper alloys, an oxidizing atmosphere should be used with an oxidizing flux. A copper oxide cover sometimes is employed to prevent hydrogen absorption. In most red brasses and tin bronzes, a slightly oxidizing atmosphere should be used with a neutral glass and borax cover. Yellow brass and

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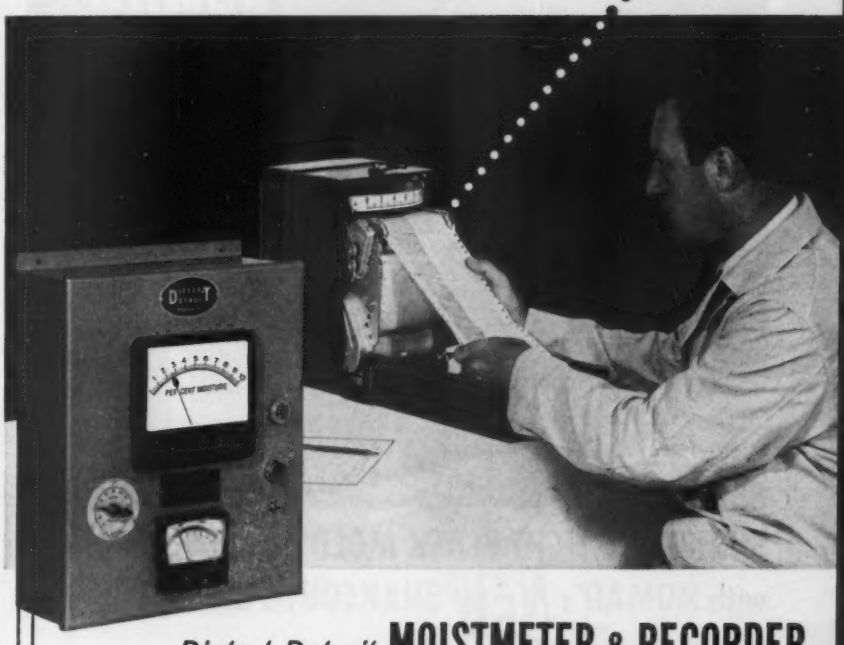

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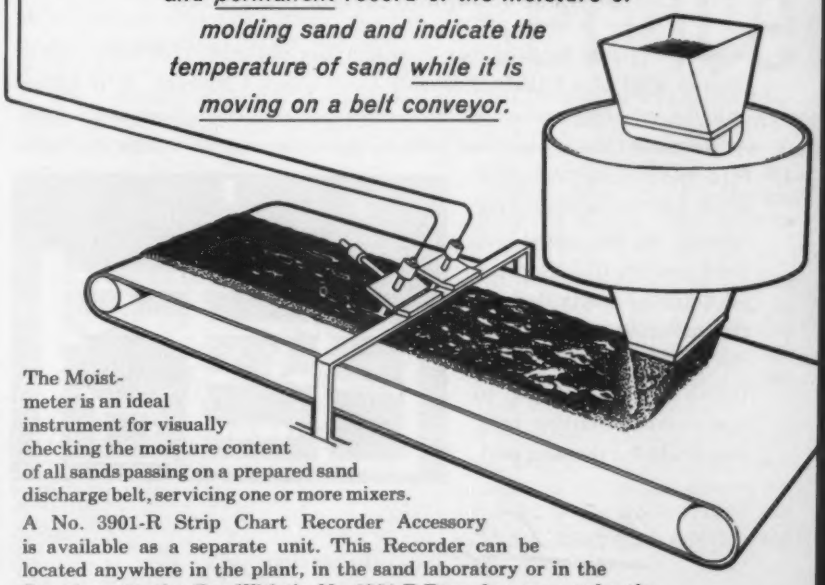

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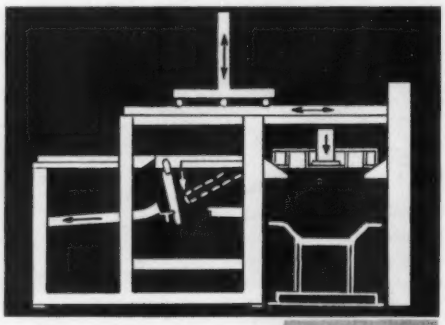

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manganese bronze need a neutral or slightly reducing atmosphere, possibly with a neutral glass and borax cover. Aluminum bronze requires a neutral atmosphere with a dry, burnt-charcoal cover. Silicon bronze should be melted in a slightly oxidizing atmosphere with a burnt-charcoal cover.

During the casting of alloys containing a higher percentage of volatile or oxidizable constituents, certain extra additions must be made to compensate for these losses. As a result, higher zinc additions must be made to yellow brasses than to red brasses. Remelting of aluminum bronze returns sometimes may necessitate the addition of aluminum. Phosphor-bronzes often require phosphorus or other additions depending on the method of remelting, degree of superheating, and time held in the molten state.

Since lead is practically insoluble in copper, the problem of unevenly dispersed lead in bearing bronzes and other leaded alloys must be overcome. In the low leaded variety (up to approximately 7 per cent Pb) presence of small amounts of nickel (about 1 per cent) helps distribution of the element. In the higher lead bronzes, however, dispersion must be achieved by the presence of 0.5 per cent sulfur. Some foundrymen state lithium is good as a dispersing agent also.

Miscellaneous Considerations— Foundrymen who check their metal carefully report that ingots from different sources vary in their shrinkage characteristics, claiming that sources whose metals indicate less shrinkage, in turn indicate lower metal losses and a higher yield. This may be true on rare occasions but is not a general rule.

It is possible for a given alloy from two different sources to have different relative shrinkage values, because each alloy has a chemical tolerance range; moreover the material from different sources has undergone different degassing, fluxing, and alloying treatments, both at the time of preparation and during casting. By keeping a running record of the metal losses during melting (weight of ingots used minus weight of metal cast) a number of alloy ingot sources can be compared.

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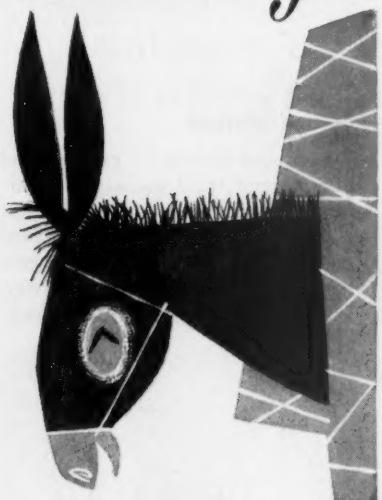

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siderable losses can be averted is to avoid the maintenance of oversized inventories which tie up much needed working capital. Inventories are maintained basically for current schedules and future production requirements over a certain period. They also are a reserve against late delivery from suppliers, temporary unavailability of a particular material, or an unforeseen increase in sales. By determining the most effective inventory level and putting excess inventory dollars back to work, hidden costs can be reduced further.

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QUALITY SERVICE DEPENDABILITY

Ohio Ferro-Alloys Corporation
Canton, Ohio

PATENTS of INTEREST

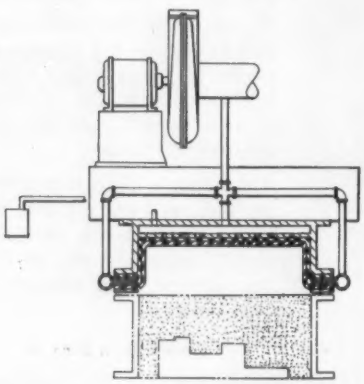
Degasifying Agent

A method of scavenging dissolved gases from molten aluminum and its alloys involves addition of a shaped compacted mass of an intimate mixture of hexachlorethane, a particulate filler material which is solid at the temperature of the molten metal, and at least one salt to sinter with the filler material. Amount of hexachlorethane may be between 10 and 70 per cent by weight.

The filler material may be sodium chloride, firebrick, sillimanite, sand, magnesite, etc., and may range in weight from 30 to 90 per cent. The salt is selected from the group consisting of sodium and potassium nitrates, borofluorides, and silicofluorides in an amount between 2 and 15 per cent by weight. *Patent No. 2,965,477 granted to V. Kondic and A. R. Watson and assigned to Foundry Services International Ltd.*

Diaphragm Molding

Improvement in diaphragm molding machine consists of two contiguous diaphragms which eliminate difficulties from puncturing. Additionally a vacuum is employed to



draw the diaphragms up into the head of the machine between molding cycles. Vacuum also is introduced between the two diaphragms to hold them together at all times so that they move together in unison and prevent chafing. In molding, the diaphragms are forced down into packing relation with the sand by air pressure at the top. *Patent No. 2,962,776 granted to R. W. Taccone and assigned to Taccone Pneumatic Foundry Equipment Corp.*

Exothermic Compound

Material which is placed on the surface of the riser of a casting or on the top of an ingot mold aids in feeding, and minimizes or eliminates silicon pickup in the casting or ingot. Result is said to be accomplished by addition of nickel and copper to the aluminum-iron oxide mixture. One composition is given as containing 23 parts by weight Al, 76 parts Fe_3O_4, 0.7 parts Cu, and 0.3 parts Ni.

The material is placed on top of the ingot when incipient solidification begins, in the amount of 15 lb per 2000 lb metal. Another example contains 21 parts by weight Al, 69 parts Fe_3O_4, 0.7 parts Cu, 0.3 parts Ni, and 9 parts fluorspar. Addition of fluorspar reportedly enables metal trapped in the slag to run back into the body of molten metal. *Patent No. 2,937,425 granted to H. M. Morgan and assigned to Foundry Services International Ltd.*

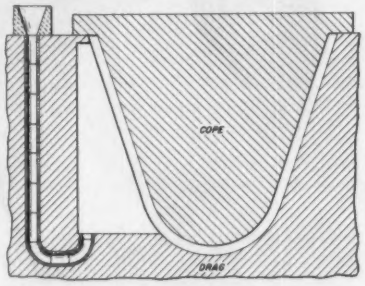
Molding Machine

Method of moldmaking involves simultaneous squeezing and jolting. This is accomplished by mounting, above the flask, air cylinders containing pistons which are attached to a squeezing means. Control valves on each of the cylinders permit adjustment of pressure to provide differences in squeezing action if desired.

In operation the flask is filled with sand. Then the squeezer cylinders are placed in operation, and that is followed by energizing the jolting mechanism without interrupting the squeezing action. *Patent No. 2,959,828 granted to Edgar L. Frankenstein and assigned to Herman Pneumatic Machine Co.*

Gating Method

Improved method for gating metal into a sand mold to retain metallurgical advantages of top gating and eliminate its mechanical disadvantages employs a fin or vertical gate opening into the casting cavity. The system includes a sprue for feed-



ing molten metal into the gate from the bottom.

The gate consists of a vertical compartment about the same size as the sprue and a vertical channel leading into the mold cavity. This channel is wedge-shaped, with the narrow side at its attachment to the vertical compartment and the wide side at the casting cavity. This restricts the flow of molten metal into the cavity and eliminates turbulence. The vertical channel also is wider at the top than at the bottom to decrease the metal flow as it fills. *Patent No. 2,962,780 granted to L. W. Krum and assigned to U. S. Steel Corp.*

Austenitic Steel

Composition of low-manganese austenitic steels characterized by high wear and impact resistance, good tensile ductility, and ability to work harden rapidly in service is as follows: 1.00 to 1.25 per cent C, 6.00 to 8.00 per cent Mn, 2.00 to 4.00 per cent Cr, 0.05 to 0.15 per cent Al, 1.00 per cent Si max., 0.04 per cent S max., 0.04 per cent P max., and remainder Fe.

The alloy is heat treated at 1100° F for 2 to 16 hours, and slowly cooled about 50 to 150 degrees per hour. In that condition

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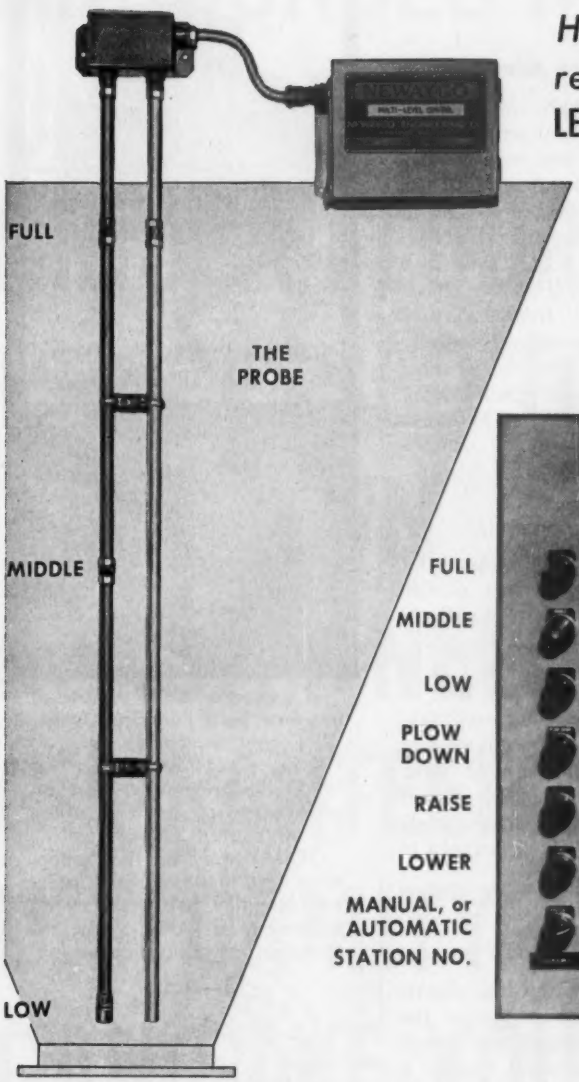

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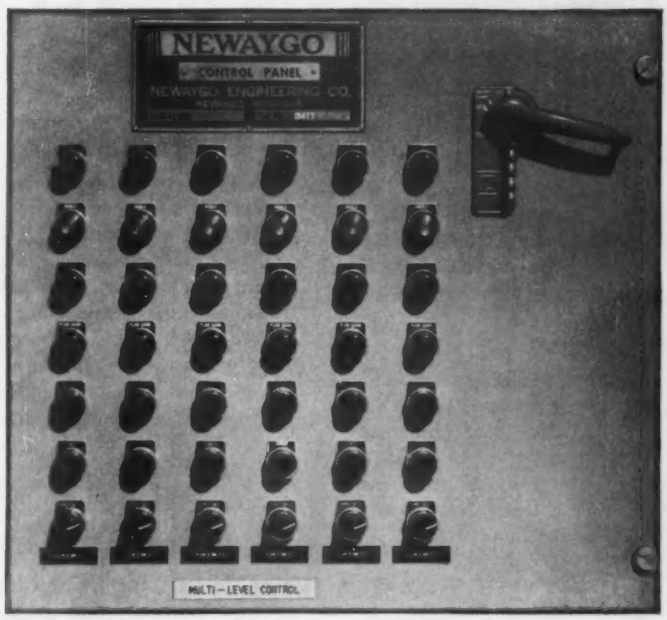

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it may be machined quickly and easily. Then the alloy is heated at about 2000° F for 1 to 4 hours and quenched in water, air, or oil, depending on section thickness. Alloy shows tensile strength of 100,000 to 140,000 psi, elongation of 16 to 44 per cent, and reduction of area of 20 to 46 per cent. *Patent No.* 2,-965,478 *granted to C. H. Armitage and assigned to Allis-Chalmers Mfg. Co.*

High-Temperature Alloy

Cast molybdenum - base alloy which shows excellent tensile properties at 1600° F may contain 0.01 to 0.08 Zr, not more than 0.005 O_2, not more than 0.25 C, and a metal from the group consisting of Ti up to a maximum of 0.22, Co up to a maximum of 0.2, Cb up to a maximum of 1, and V from 0.25 to 1 per cent, with remainder essentially Mo. *Patent No.* 2,960,403 *granted to G. A. Timmons and Marion Semchyshen and assigned to American Metal Climax Inc.*

CO_2 Sand Binder

Sodium silicate bonding agent for sand used in the carbon dioxide process is composed of 80 to 99 per cent liquid silicate with an SiO_2 : Na_2O ratio of 3.22 : 1, and 1 to 20 per cent of a solid silicate such as sodium metasilicate. Organic materials such as sugar, sorbitol and glycerine in amounts around 5 per cent also may be included. *Patent No.* 2,952,553 *granted to F. P. Ilenda and C. E. Peeler Jr. and assigned to Diamond Alkali Co.*

Metal Fluxing Material

Material for deoxidizing, degassing, cleaning, and improving the ductility and machinability of metals is described as having a core of a highly heat-resistant material which is coated with carbonaceous matter. The core material is indicated to have a composition of 81.1 per cent silica and 18.4 per cent alumina, and in a size range of 4 to 225 microns. The particles are coated with carbon by heating to 1300° F and passing crude petroleum over them. *Patent No.* 2,952,534 *granted to J. M. Quinn and T. A. Lundbergh, and assigned to J. M. Quinn.*

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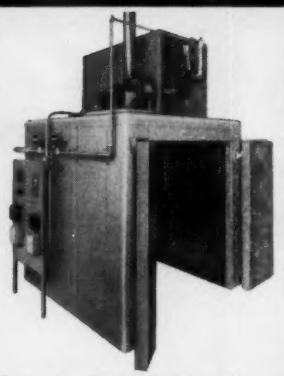

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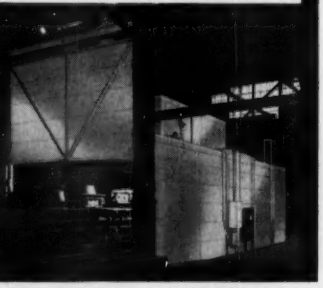

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The SANDMAN Says . . .

"Sand Problems and Friends"

By HAROLD E. HENDERSON
H. C. Macaulay Foundry Co.
Berkeley, Calif.

I have six sand-consultant friends;
They've taught me all I know.
Their names are Charlie, Clyde, and Frank,
And Harry, Tom, and Joe.
Now each is expert in his field—
No ifs or ands or buts.
Yet each implies the other five
Are just a wee bit nuts!
(With no apologies to Kipling)

● DON'T let that bit of doggerel mislead you. These boys are my friends, and I admire every one of 'em! And I believe that in a condescending way they have some affection for me. I also believe that at heart they have great respect for each other and affect a derogatory tone in keeping with their own opinions.

I descend to this bit of raillery simply to make a point—namely, that every man has a right to look on himself as an expert in some particular and to some degree. And he should feel neither offended nor dismayed if one or more of his contemporaries speaks slightingly of his pet theories.

On closer examination, we find that men are wiser than they know and that even the apparent foundry lowbrow may be capable of a surprising and valuable contribution. It is said that a flea on top of an elephant can see farther than the elephant. By similar reasoning, a foundry underling may possess a bit of understanding surpassing that of his boss. Being an underling myself, I find such philosophy consoling.

Looking back over the last 50 years, I remember molders, helpers, and apprentices who used to bend their backs for long hours in dark and dirty foundries, engaged in ignominious toil. I am old enough to remember such conditions, although they now are little more than a bad dream.

I have watched the advent of the molding machine, synthetic sand control, mechanized lifting and movement of molds and materials, and innumerable other mechanical aids. These advances have removed or reduced muscular strain, increased the earning power of all concerned, and greatly dignified the entire industry.

These gains were not achieved by any single individual, however, nor were they the brainchild of genius. Rather, they were a matter of many minds working consciously toward a similar goal. Intelligence is found in unexpected places, and no one has a monopoly on it.

My sand consultant friends may differ audibly, but each knows that the others have contributed to the progress of our industry to an extent difficult to evaluate. And let's not underestimate the man with the shovel or the boy who operates the muller, for they should be acquainted intimately with the sand we are attempting to control. Let's not judge their intelligence by the condition of their garments.

Some time ago, I was presented with a small book, beautifully printed and illustrated on glazed paper, bound in blue cloth, with the cover lettered in gold. It carried the rather lengthy title *Progress In the Development and Utilization of Additives In The Foundry Industry*. It covers the foundry additive story from 4000 B.C. to 1960 A.D.

I frequently find occasion to refer to this little volume, and always profitably. Its author, a man whom I have met briefly on only two occasions, impressed me as an unusual individual who obviously is dedicated to the advancement of foundry practice. Aside from those brief meetings and consequent impressions, I know the man by reputation only, through foundry literature and the word-of-mouth endorsement of his friends and admirers.

I might be said to know him, just as I know Washington and Lincoln, via the printed page. But, despite my reverence for these great men, I feel considerably closer to and more dependent on the author of the work on foundry additives. He speaks my language in the true vernacular, and the message he communicates couldn't possibly have been conceived of by Washington or Lincoln.

This gentleman (my author) can afford to be benevolent as he approaches the retirement stage. His success is the reward for goods and services beyond estimable value. His biography would require a volume much larger than his booklet on additives, and I'm sure that it would prove inspiring reading to most of those who have benefited directly from his genius.

Lincoln has been quoted at various stages of his formative career. As a teenager, he is reported to have said, "My best friend is the man who'll git me a book I ain't read!" Well, Joe not only got me

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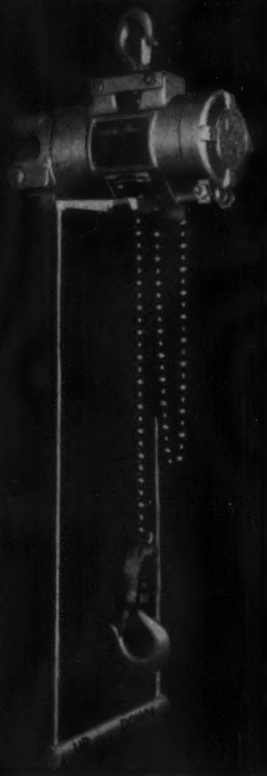

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the book, but wrote it, so by Lincoln's estimate, Joseph A. Gitzen must be my friend.

If confession is good for the soul, it behooves me to confess freely that there are many things concerning the study of foundry sand which I fail to understand completely. For years I worried about the AFS grain fineness number, derived from some sort of a mathematical average, only to learn that it has little if any practical significance to the foundryman. Two sands of widely different characteristics can carry the same grain fineness number.

This average business can prove misleading. We hear repeated reference to the average man, but I never have met a man who would admit to being average. In many highly academic studies of sand properties, we are confronted with theoretical concepts which I assume hold exciting promise to the fraternity of the laboratory, but are meaningless to the so-called practical foundryman.

The great majority of jobbing foundries operate without benefit of a sand reclamation system in the full sense of that term. We do the best we can with the equipment available. Starting with the old screen and shovel, we advance to a portable power screening and aerating device, then to a muller and more aeration.

When funds permit, we invest in lump breakers, more capacious and selective screens, magnetic separators, and some form of dust and fines removal. Then, we pat ourselves on the back in the belief that now we have it licked! Production is increased and loss is lowered, with undeniable improvement in casting appearance. No doubt about it, our investment has paid off.

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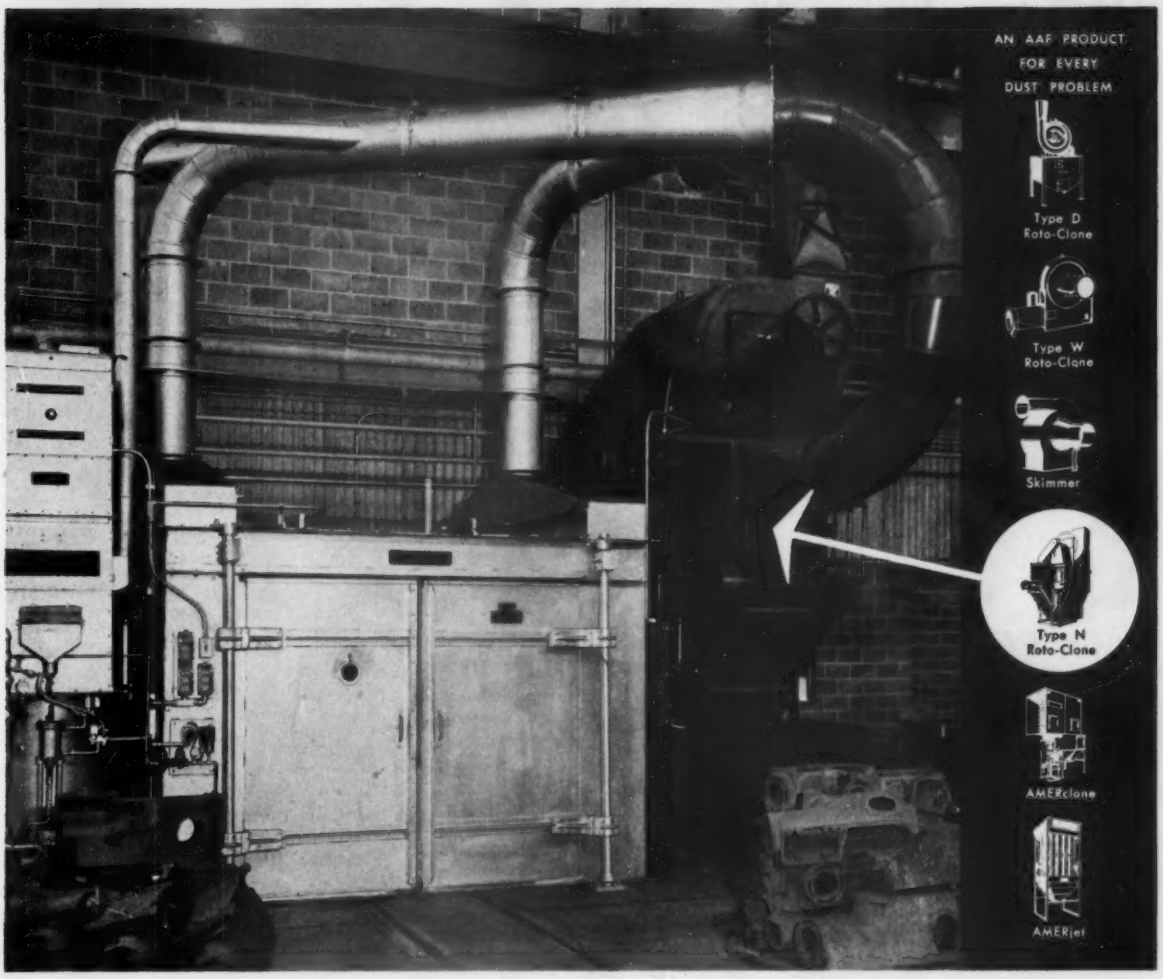

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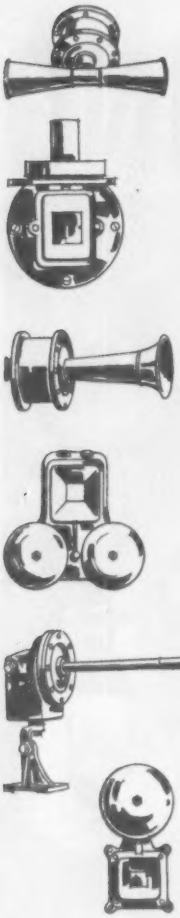


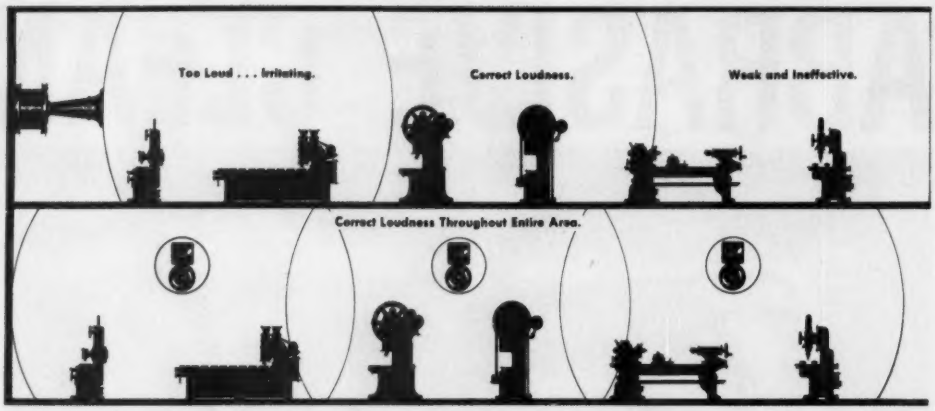


Fig. 1—Upper diagram illustrates an incorrect signal application. Some workers are irritated by this one; others can't hear it. Bottom diagram shows proper system

What You Should Know About SIGNALS

By ROBERT J. BARNARD

Executive Vice President and General Manager
Sperti Faraday Inc.
Adrian, Mich.

● SIGNALS are becoming more important everywhere in industry. Every day, signals of all types are used for more and more communications and monitoring jobs. Nearly every home, school, hospital, industrial plant, large machine, and vehicle uses a signal in one form or another.

Many problems arise in signal installations, but no matter what the problem, chances are there's a signal made to solve it. But there's a lot more to signals than meets the eye. Designing, selecting, positioning, and installing the right signal to do the right kind of job is an exacting science.

This article tells about the major types of signals available with their specific uses, lists the general types of signal systems, and explains signal tone-range performances. It explains how to check to see if your signals are placed properly and suggests how to best use the signals you already have. If you're planning to build or modernize a plant, there is a check list of questions to answer about signals which should help you install the proper system.

Types of Signals — Horns are among the most common signals in use today. They usually have loud, sharp, clearly-defined tones for specific uses. The wide range of their loudness makes them suitable for a wide variety of industrial applications. They are used commonly for alarm-signaling, for start and stop work-signaling, and for general code-paging work. Types are available for conventional or flush mounting, for interior or exterior use, for electrical, manual, or air operation.

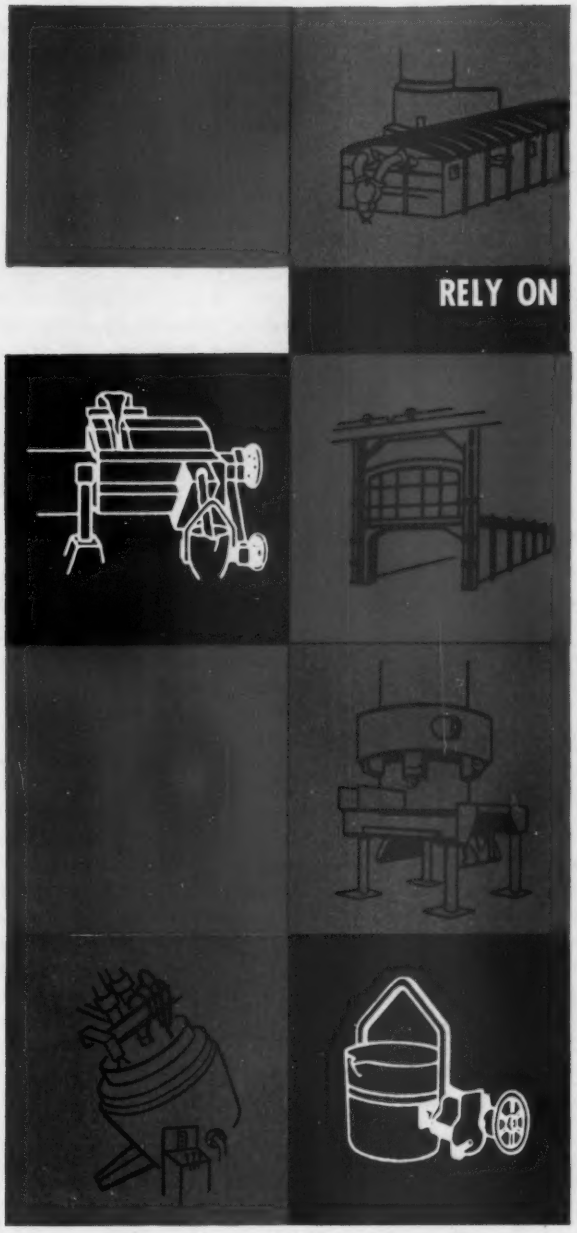
Sirens are the most powerful and attention-getting of all signals, hence their popularity for use on ambulances and fire trucks. They have the greatest range since some can be heard up to half-a-mile under favorable conditions. Suitable for emergency signaling, they also are used as start and dismissal signaling in foundries, mills, switch yards, and similar indoor and outdoor locations involving large areas.

Bells are easily the most versatile of signals produced. They come in a broad selection of sizes and tonal ranges. Larger models are used for fire and burglar alarms, for code-paging, for schedule signaling, and time telling. They range in tone from quiet and gentle to insistent and strident.

Buzzers seem to be the only solution to many signaling problems. They are popular for general signaling and alarm purposes in plant offices and departments where a more startling signal would be out of place. They also are used commonly for indicating and paging signals.

Chimes are pleasant sounding, yet effective to use. They are recommended for locations of low noise levels, such as in offices. Their loudness ratings assure audibility, and their mellow, musical tones always are inoffensive. Chimes usually are put to work for paging systems only in plants where noise levels are low.

Annunciators are used to pin-



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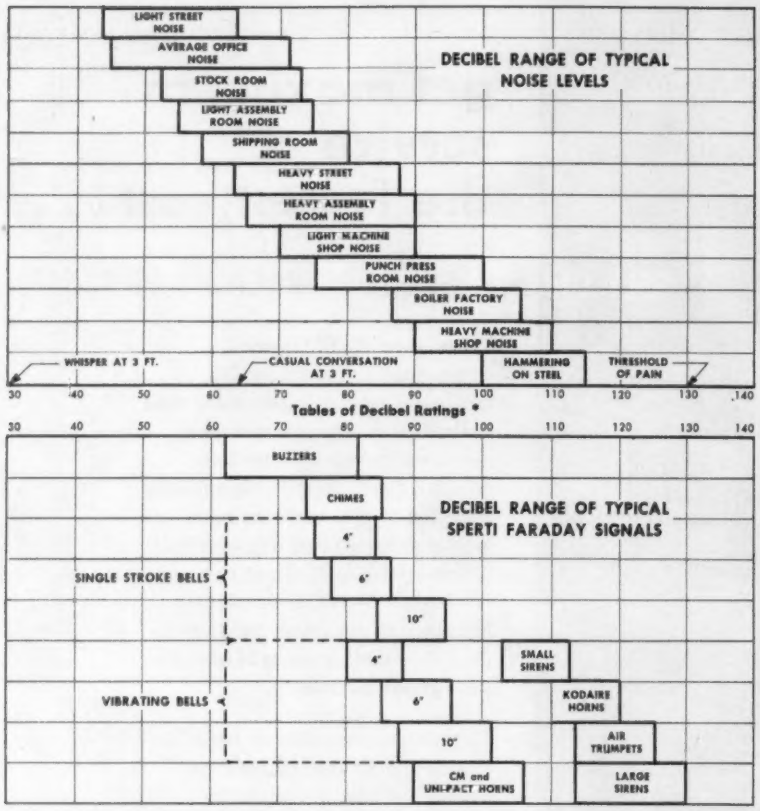


Fig. 2—Chart compares signal tone-range performances with noise levels in various typical installations. All ratings are given in decibels

point trouble spots. They are available in numerous sizes, both audible and visual, or a combination of both.

Signal Systems—A number or variety of signals combined to do one or various jobs usually are installed at one time and are known as signal systems. Here are descriptions of the major kinds and how they are used.

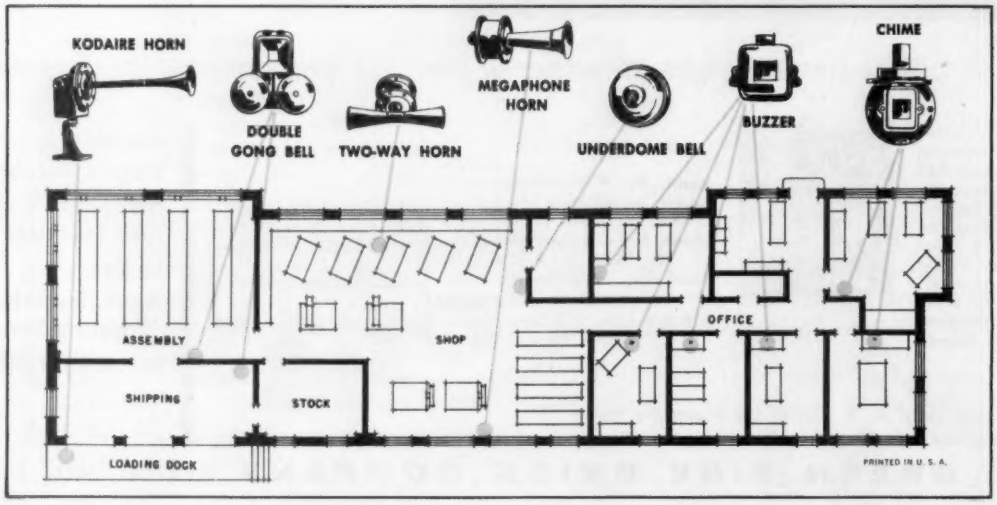
Paging systems are designed to keep key personnel as near as your desk or switchboard. They are more efficient than systems consisting of a number of separate signals at various points in the plant. Signals are useful with telephone extensions in noisy departments which may require a louder bell, buzzer, or horn if the normal ring is inaudible.

Start-dismissal systems are used extensively to open and close work shifts. A similar system often is used for periodic signaling such as indicating morning and afternoon coffee break periods or lunch hours, and for scheduling testing or production functions that must be performed at the same time every day.

The fire alarm system is one which, if well planned and properly located, can save a company from ruin, protect the lives of employees, and make possible getting the jump on locating and extinguishing a fire. The burglar alarm system is of a similar nature. It can be arranged to protect every possible point of entry to your plant or building.

Indicators are another type of signal that can be useful. Trouble indicators can be mounted on panels, switchboards, and machines to warn of abnormal operating conditions. For example, a signal can be teamed up with a thermostat to sound an alarm if a bearing begins to overheat. The gas station wire is an example of another signal—the tell-tale indicator. A system of this type can be used to sound a warning when a vehicle

Fig. 3—Wide range of signaling requirements in a typical plant requires various signals ranging from chimes in offices to horns in noisier areas



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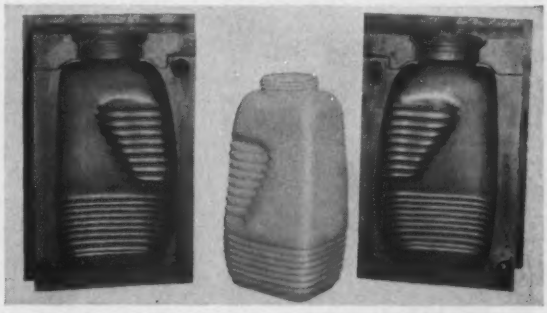

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passes the plant gate or enters a certain part of the plant.

Outdoor Signals—The problem of hearing signals outdoors is increased many times compared to indoor signals. Outside, there are no walls, floors, or ceilings to reflect the sound. Trees in the area absorb sound, and other structures cause "acoustic shadows" that direct and distort the sound of signals even more.

Large open fields are the most difficult to service properly, because sounds are so easily dissipated. More powerful signals are required outdoors. It is recommended that several signals be spaced evenly throughout the area. This is much more efficient than locating them at one central point, even though additional wiring is necessary.

The two charts in Fig. 2 show the decibel range of typical noise levels in a plant and show typical decibel ranges of signals. All ratings are given in decibels, the standard sound unit used in the sound engineering field. One decibel is the smallest degree of sound difference your ear can detect. An increase of about 8 decibels means that the noise intensity has been doubled. Thus, a decibel rating of 108 is twice as loud as a decibel rating of 100.

As shown in the charts, particular signals are best suited to particular needs. All signal ratings shown above have been taken and computed at a point 10 ft from the source of the sound.

A well-planned, correctly installed signal system will improve quality control, improve employee productivity, improve employee safety, help lower costs by saving down time, and monitor and protect your plant and equipment. To reap these benefits special attention should be paid to the following factors when selecting a signal system for specific needs. It shouldn't be a hit-or-miss proposition; money will be saved and the system will operate with maximum efficiency if the right one is chosen.

Usually in a multi-signal installation, more than one type of signal will be desirable (see Fig. 3). A good idea is to make a similar diagram of your own premises, and use data given in Fig. 2 to help select the proper signal. The following questions can be used as a guide:

1. Where is the signal to be used? Signal location is very important. Each signal must be tailored to a given location to gain attention without being annoying. You wouldn't think of using a loud horn in the executive offices or a soft chime in a punch press department. But it's been done.

2. What noise level has to be overcome? Noise levels vary from plant to plant, and from room to room in a given location. The signal performance chart will help determine the approximate noise level and show what types of signals to use.

3. What type of noise will be encountered? The type of noise is just as important as the noise level. In a power plant, the tone of a horn or siren may blend in with the humming generators and become inaudible. Here, a bell would be more desirable, even though it might have a lower loudness rating. Similarly, in a machine shop the constant clanking sound of metal may drown out a bell, and a horn would gain more attention. A good rule to follow is to use a signal that is either louder, or different, than surrounding noise.

4. What is the purpose of the signal? Obviously all signals can't serve all signaling functions. A siren may be an excellent warning device to spread the alarm of fire or burglars, but it isn't recommended for code-paging. It's excellent as an emergency signal. Bells, buzzers, and horns are good all-around signals and can be used for general alarm, start-dismissal systems and simple code-paging. It is important to appreciate the limitations, as well as the potential, of any given signal.

Points to Remember—1. Make sure there are enough signals, evenly spaced throughout an area. 2. Select a signal with a tone that gains attention without annoyance. 3. Select a signal that is louder or different than surrounding noise. 4. Select a signal that is suitable to its location. 5. Use signals with clear, resonant, pleasant tones for common uses like code-paging, scheduling. Use startling tones for alarms and emergencies. 6. Make sure the signal selected can perform its intended function.

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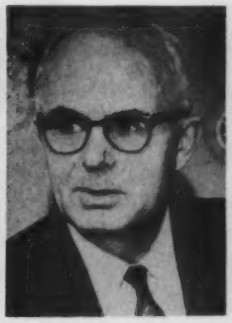


CHARLES C. JARCHOW

NORMAN A. BIRCH
. . . joins Albion Malleable

Joseph O. Danko Sr. has been named board chairman of the newly formed Danko Arlington Inc., Baltimore, following the merger of Danko Pattern & Mfg. Co., and Arlington Bronze & Aluminum Corp. **Joseph O. Danko Jr.** is president of the new company, and **Norbert J. Hynson**, vice president. Other officers include **George A. D'Andrea**, vice president, Foundry Div.; Franklin C. Weegar, vice president, Machine Div.; **H. Dorsey Hammond** vice president-sales; **J. E. Blair**, treasurer, and **A. D. Wallace**, secretary.

Edgar W. Bliek has been named manager of the Foundry & Metallurgy Div., Gleason Works, Rochester, N. Y., a new manufacturing division which includes the foundry and sheet metal, heat treat, and plating departments.

Leonard A. Wood, production superintendent at the Tonawanda, N. Y., plant of Chevrolet Motor Div., General Motors Corp., has been made general superintendent of production at the company's aluminum foundry in Massena, N. Y. He succeeds **George H. Johnson**, who has become general superintendent of production at Chevrolet's gray iron foundry, Saginaw, Mich.

Martin W. Peterman, vice president-general manager, Milwaukee Faucets Inc., Milwaukee, has been elected president of the Plumbing Brass Institute, Pittsburgh. **Ford V. Cowing**, president, Repcal Brass Mfg. Co., Los Angeles, has been named first vice president.

Charles C. Jarchow has retired as chairman of the board, American Steel Foundries, Chicago, after nearly 50 years of service. President from 1949 to 1959, he will continue as a director. **Marion J. Allen** has been named a vice president of the company, and will continue as director of the Personnel and Public Relations Div. **Goff Smith**, vice president, has been elected a director to fill the vacancy on the board caused by retirement of **Chauncey Belknap**, a director since 1929.

Arthur M. Wehrmann has been appointed to the new position of director of personnel, National Malleable & Steel Castings Co., Cleveland, to handle companywide recruitment and training and to coordinate personnel porgrams in all company plants and offices. **Herman Worrell**, formerly personnel manager of the Melrose Park, Ill., plant, succeeds Mr. Wehrmann as personnel manager at the Chicago plant.

Kurt A. Miericke has joined Racine Foundry & Mfg. Co., Detroit, as director of quality control. He was with Baroid Chemicals Inc., subsidiary of National Lead Co., Houston.

Norman A. Birch has been appointed technical director, Albion Malleable Iron Co., Albion, Mich. Formerly with American Brake Shoe Co.'s National Bearing Div., which he joined in 1939, he served as metallurgist and general foundry superintendent. Recently he was director of research at the division's Meadville, Pa., plant.

Harold C. Erskine has been elected an executive vice president, Aluminum Co. of America, Pittsburgh. He continues as vice president in charge of production. Mr. Erskine was manager of the Cleveland works from 1943 until 1952. In 1957 he became vice president in charge of smelting and fabricating, and vice president in charge of production last year. **John D. Harper** has been named vice president in charge of the smelting and fabricating divisions. He has been general manager of the smelting division.

Milton K. Mahler, Morrow Steel Co., Detroit, has been re-elected president of the Institute of Scrap Iron & Steel Inc., Washington. **I. D. Shapiro**, United Iron & Metal Co., Baltimore, has been elected treasurer, and **Leonard I. Abrams**, Atlas Steel & Supply Co., Cleveland, secretary.

Del S. Harder has been named a director of Aluminum Industries Inc., subsidiary of Glen Alden Corp., Cincinnati. Before his retirement in

. . . MEN of INDUSTRY

A. BRENT WILSON

EARL A. GARBER

. . . promotions at Harbison-Walker Refractories

HERBERT J. COOPER

. . . Cooper Alloy pres.

1959, he was a vice president of Ford Motor Co., Dearborn, Mich., and continues as a director there.

Robert W. Payne has been appointed sales administrator at the Cleveland Div., Precision Castings Co., Cleveland. He joined the company in 1952. It is a division of Precasco Corp., a part of Fulton Industries Inc., Atlanta, Ga.

Charles D. Evans, assistant manager, has been named manager of manufacturing research, International Harvester Co., Chicago. He joined the company in 1939, and since 1953 was assistant manager. He succeeds **W. D. Bryson,** newly elected vice president of Solar Aircraft Co., a subsidiary.

Don W. Smith has been named midwest regional representative, Industrial Truck Div., Hyster Co., Portland, Oreg. Since 1958 he has been with the company's retail branch in Chicago.

Robert M. Green, until recently with Chapman Valve Mfg. Co., Indian Orchard, Mass., subsidiary of Crane Co., Chicago, has joined Metallurgical Associates Inc., Boston, as vice president and general manager.

C. T. Hendricks, formerly general foreman, manufacturing, Ingersoll-Rand Co., Painted Post, N. Y., has been named superintendent of the modernized steel, gray iron, brass, and aluminum foundry, General Railway Signal Co., Rochester, N. Y.

Earl A. Garber has been elected chairman of the board and chief executive officer, Harbison-Walker Refractories Co., Pittsburgh. **A. Brent Wilson** succeeds him as president, a position Mr. Garber held since 1948. Mr. Wilson has been executive vice president since 1958.

Price B. Burgess has been appointed research and development manager, Albion Malleable Iron Co., Albion, Mich. He was formerly plant metallurgist at the company's Muncie, Ind., plant where he has been succeeded by **Melvin W. Devers. Eugene F. Chojnowski** is plant metallurgist at Albion.

Calbraith P. Champlin Jr., formerly executive vice president, Strong Steel Foundry Co., Buffalo, has been elected president of the company.

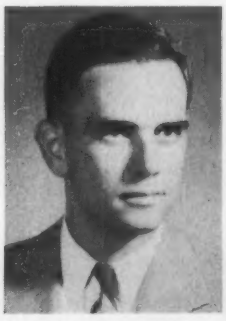
Sherman B. Burke has been appointed vice president-sales, Hanna Furnace Corp., Buffalo, subsidiary of National Steel Corp. He replaces **C. R. Welles,** who has retired after 30 years with the company. **Roger S. VanDerKar** becomes general sales manager, to succeed Mr. Burke. **Alden W. Gallup** has been named Detroit district sales manager, Mr. VanDerKar's former position.

Herbert J. Cooper, executive vice president, has been elected president and chief executive officer, Cooper Alloy Corp., Hillside, N. J., and its subsidiary, Vanton Pump & Equipment Corp. Div. He succeeds **Harry A. Cooper,** company founder, now board chairman.

Paul M. Herring, since 1950 vice president and assistant treasurer, Kutztown Foundry & Machine Corp., Kutztown, Pa., has been named president. He succeeds his father, **Edgar W. Herring,** who resigned recently after ten years as president.

Louis S. Goldberg has been appointed director of marketing for the Buell Engineering Co., New York, and its Northern Blower Div. in Cleveland.

Waldo V. Tiscornia, executive vice president and assistant general manager, has been elected president and general manager, Auto Specialties Mfg. Co., St. Joseph, Mich., succeeding his brother, the late James



ROBERT M. GREEN

. . . becomes v. p.-gen. mgr.

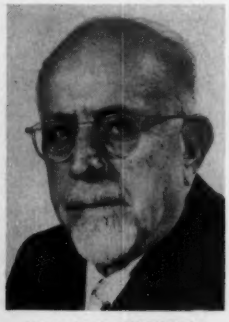
C. T. HENDRICKS

. . . becomes foundry supt.

ROGER S. VanDerKAR

SHERMAN B. BURKE

. . . Hanna Furnace promotions



WALDO V. TISCORNIA

. . . Auto Specialties pres.

SILICONE NEWS from Dow Corning

A Complete Shell-Out!

Silicones Help Shell Molders Stop Sticking, Speed Production

Don't let sticking slow your shell-mold production . . . nor step up scrap, or delay production schedules. Shelve your sticky problems permanently by using Dow Corning 8 Emulsion. Assure yourself of clean, easy release, retention of detail and maintenance of close tolerances.

Just a light coating of 8 Emulsion on patterns gives instant release of resin-sand shells and cores. You eliminate stickers and reduce expensive mold maintenance and replacement.

The silicone release coating obtained with Dow Corning 8 Emulsion resists heat . . . doesn't flash off or evaporate at mold curing temperatures . . . doesn't carbonize. Build-up on patterns is kept to an absolute minimum. Patterns stay clean many cycles longer — you may even find fewer are needed.

Easy does it. Simply mix Dow Corning 8 Emulsion with water . . . in the ratio most suitable for your process and in the volume most practical for your production schedule. Then, apply the mix by dip, brush or spray. The emulsion's stability and fast wetting action produce a uniform film that gives overall, easy release and provides excellent surface finish.

Technical service . . . fast delivery . . . lowest price! Dow Corning's constant research and development in silicone chemistry means our customers receive the newest and the best possible silicone products at lowest price. Phone or write the Dow Corning office nearest you for prompt technical assistance, or for fast delivery from warehouse stocks.

Write for "how-to-do-it" manual describing use of silicone parting agents in shell-molding. Address Dept. 4115.

first in silicones

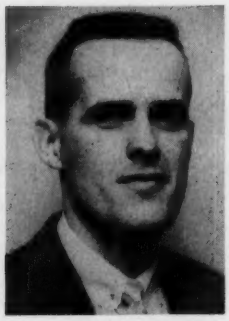
Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

Circle 663 on Page 39

. . . MEN of INDUSTRY

ALBERT W. GRUER JR.



ROY G. HECKENKAMP
. . . changes at Carondelet Foundry

JOHN H. CULLING

W. Tiscornia. **R. M. Foote** has been named president and general manager of Auto Specialties Mfg. Co. (Canada) Ltd., Windsor, Ont., the Canadian affiliate. Mr. Foote is successor to the late W. H. Cantelon.

E. A. Walcher Jr. has been named co-ordinator of research, product engineering, manufacturing and sales activities, a new position at American Steel Foundries, Chicago. **R. O. Tibbals** succeeds him as vice president-manufacturing of the Transportation Equipment Div. **A. P. Steinhauser,** assistant works manager, becomes works manager of the Granite City, Ill., plant, Mr. Tibbals former position.

G. Blair Sheers has been elected board chairman, Standard Horse Nail Corp., New Brighton, Pa., succeeding the late Fred I. Merrick. Mr. Sheers will continue as president of the company, which he has headed for the last 18 years.

Paul Ewbank, since 1957 vice president and manager of the administrative division, Union Steel Products Co., Albion, Mich., has been named first vice president and assistant general manager. He joined the company in 1922.

Douglas B. Beath has been named sales manager of the foundry division, Foundry Services Inc., Cleveland. He joined the company in 1957 and until recently was central regional sales manager.

John H. Culling, since 1956 vice president in charge of operations, has been appointed executive vice president, Carondelet Foundry Co., St. Louis. **Albert W. Gruer Jr.** has been named vice president of marketing. **Roy G. Heckenkamp** succeeds Mr. Gruer as secretary and will continue as treasurer.

Blair R. Watkins has been named Cleveland district sales manager for Eastern Clay Products, Industrial Minerals Div., International Minerals & Chemical Corp., Skokie, Ill. He succeeds **Frank P. Tobakos,** now products manager-sand additives. **Willard L. Adams** has been appointed industrial sales manager. **Richard A. Green** takes over Mr. Adams' former duties as product manager-refractories.

Laurence L. Prince has been named sales manager, Bradley Washfountain Co., Milwaukee. He was with American Radiator-Standard Sanitary Corp., New York.

Emil J. Koepsell has been appointed special foundry sales and service representative, Nordberg Mfg. Co., Milwaukee. **William S. Flinchbaugh** succeeds Mr. Koepsell as foundry and pattern shop superintendent. Mr. Flinchbaugh was formerly foundry superintendent, Sorbo-Cast Corp., New Brunswick, N. J.

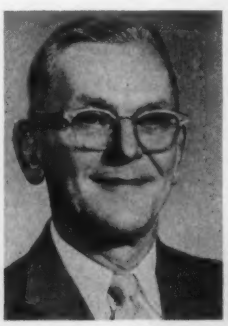
Robert M. Terry has been named president-treasurer, American Refractories & Crucible Corp., North Haven, Conn., replacing **G. T. Hubbell** as president, and **R. W. Brown** as treasurer. Messrs. Hubbell and Brown have resigned. **Richard L. Matthies** has been made secretary, succeeding **E. G. Boies,** resigned. **Bernard H. Matthies** has been named vice president and **George H. Caligan** vice president-sales.

J. J. Kroecker has been appointed sales manager, Permold Co., Medina, Ohio. **L. E. DeGroat,** for 20 years vice president-sales, continues as vice president and director, devoting his efforts to market development.

Raymond W. Sweitzer has been named general sales manager, Newaygo Engineering Co., Newaygo, Mich. He was formerly with Jeff-

G. BLAIR SHEERS
. . . becomes board chr.

DOUGLAS B. BEATH
. . . foundry div. sales mgr.

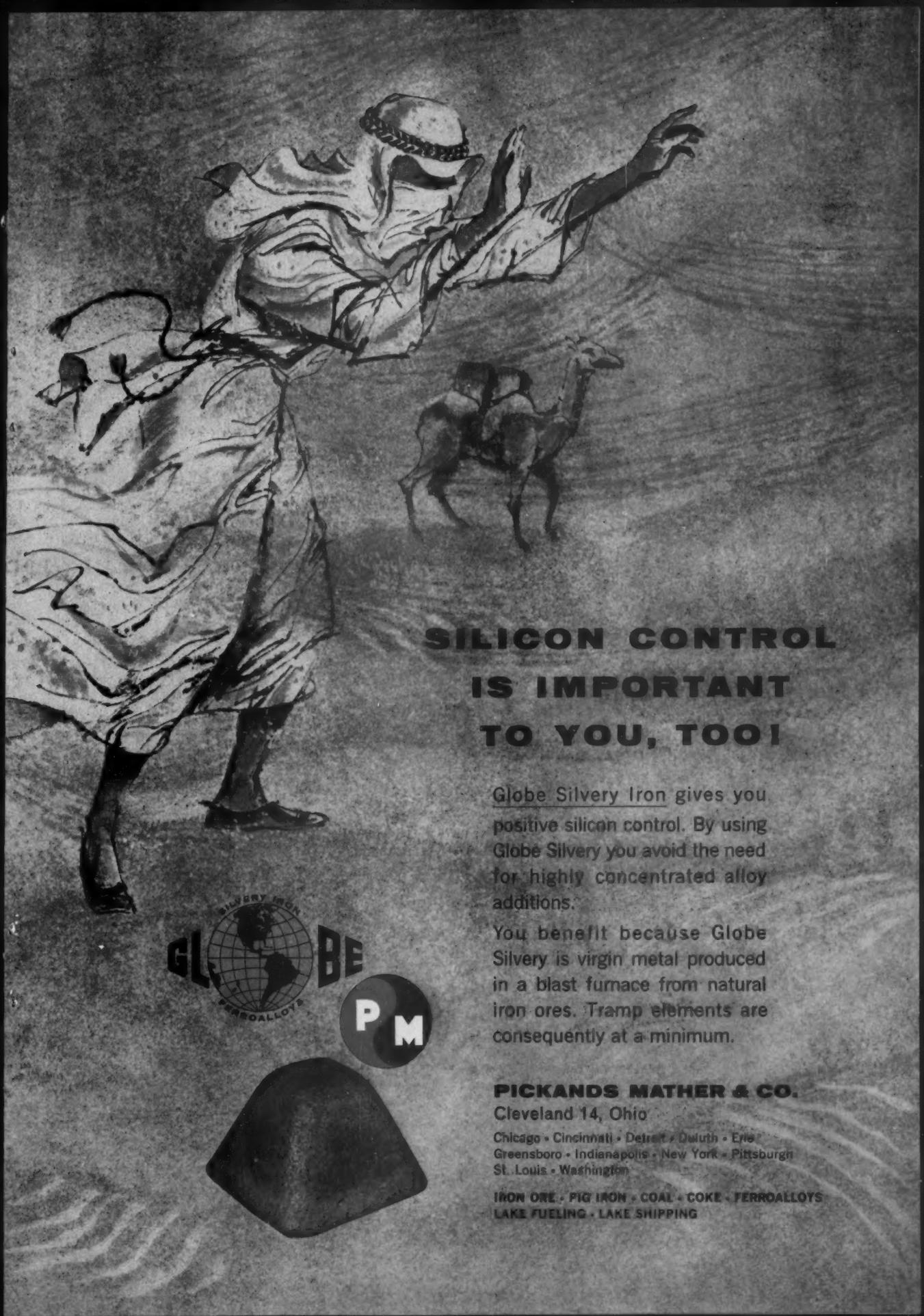


EMIL J. KOEPSELL
. . . Nordberg Mfg. appointments

WILLIAM S. FLINCHBAUGH
. . . Nordberg Mfg. appointments

RAYMOND W. SWEITZER
. . . general sales mgr.

Circle 664 on Page 39→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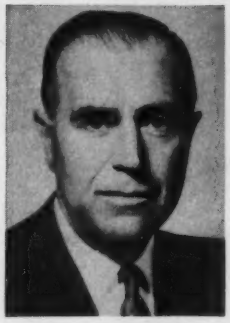
TO YOU, TOO!
Globe Silvery Iron gives you positive silicon control. By using Globe Silvery you avoid the need for highly concentrated alloy additions.
You benefit because Globe Silvery is virgin metal produced in a blast furnace from natural iron ores. Tramp elements are consequently at a minimum.
SILVERY IRON
GLOBE
FERROALLOYS
PM
PICKANDS MATHER & CO.
Cleveland 14, Ohio
Chicago • Cincinnati • Detroit • Duluth • Erie
Greensboro • Indianapolis • New York • Pittsburgh
St. Louis • Washington
IRON ORE • PIG IRON • COAL • COKE • FERROALLOYS
LAKE FUELING • LAKE SHIPPING



RALPH F. GOW

MILTON P. HIGGINS

JOHN JEPPSON

. . . promotions announced by Norton Co.

rey Mfg. Co., Columbus, Ohio, and Link-Belt Co., Chicago.

Louis P. Braemer, Brooklyn, N. Y., has been named sales representative, J. A. Kozma Co., Dearborn, Mich., to handle sales of the company's furnaces in lower New York, upper New Jersey, Connecticut, Rhode Island, and Massachusetts. **L. M. Rose,** manager of the equipment division, M. A. Bell Co., St. Louis, will cover Louisiana, Arkansas, Oklahoma and Nebraska.

R. B. Park has been appointed sales manager, Industrial Rubber and Mechanical Packings, Raybestos-Manhattan Inc., Passaic, N. J. He was assistant sales manager. **R. B. Hazard,** formerly vice president and sales manager, has been named vice president of sales for these sales divisions.

A. J. Rumley Jr., manager of La Porte Foundry Co., La Porte, Ind., has been named a trustee of Purdue University. He was graduated from Purdue in 1934 with a degree in mechanical engineering.

J. W. Palmer has been named general manager of Hydraulic Press Mfg. Co.'s Cast-Master operation in Bedford, Ohio. H-P-M is a division of Koehring Co., Milwaukee. **R. D. Critzer** takes over Mr. Palmer's former duties as sales manager at Cast-Master. Mr. Critzer was with Onsrud Machine Works Inc., Chicago.

Ralph F. Gow has been elected president of Norton Co., Worcester, Mass., succeeding **Milton P. Higgins,** now chairman. **George N. Jeppson,** former chairman, remains on the board as honorary chairman. **John Jeppson** becomes executive vice president, the position Mr. Gow has held since 1948. **Robert Cushman,** general sales manager of the Abrasive Div., replaces John Jeppson as vice president and general manager of the division. Mr. Cushman and **Richard M. Nichols** have been made directors.

Chris F. Moersch Jr. has been appointed assistant to the president, Vulcan Mold & Iron Co., Latrobe, Pa. He has been with the company since 1946 as a sales engineer.

Henry Byrne, formerly with Wheelco Instrument Div., Barber-Coleman Co., Rockford, Ill., has joined Raymond F. McHugh & Son, Philadelphia, as general sales manager.

William C. Swanson recently joined Despatch Oven Co., Minneapolis, as representative in eastern and southern Wisconsin. Previous connections include Ipsen Industries and BAS Industries, Rockford, Ill., and Hevi-Duty Electric Co., Watertown, Wis.

R. H. Merriman and **J. W. Cunningham** have been appointed district managers in Philadelphia and Pittsburgh, respectively, for Air Reduction Sales Co., Div. of Air Reduction Co., New York. Mr. Merriman, formerly Buffalo district manager, succeeds **N. F. Moody,** who recently became eastern regional sales manager for Airco. Mr. Cunningham was assistant manager of the company's equipment marketing department.

Ross S. Peterson, formerly with Magnaflux Corp., Chicago, has been appointed product sales manager, Sperry Products Co., Div. of Howe Sound Co., Danbury, Conn. He will handle the company's line of magnetic particle inspection equipment.

Quigg Lohr has been elected a vice president of American Mono-Rail Co., Cleveland. He will continue as secretary and a director. Mr.

J. W. PALMER

R. D. CRITZER

. . . promotions at Cast-Master Div.

WILLIAM C. SWANSON

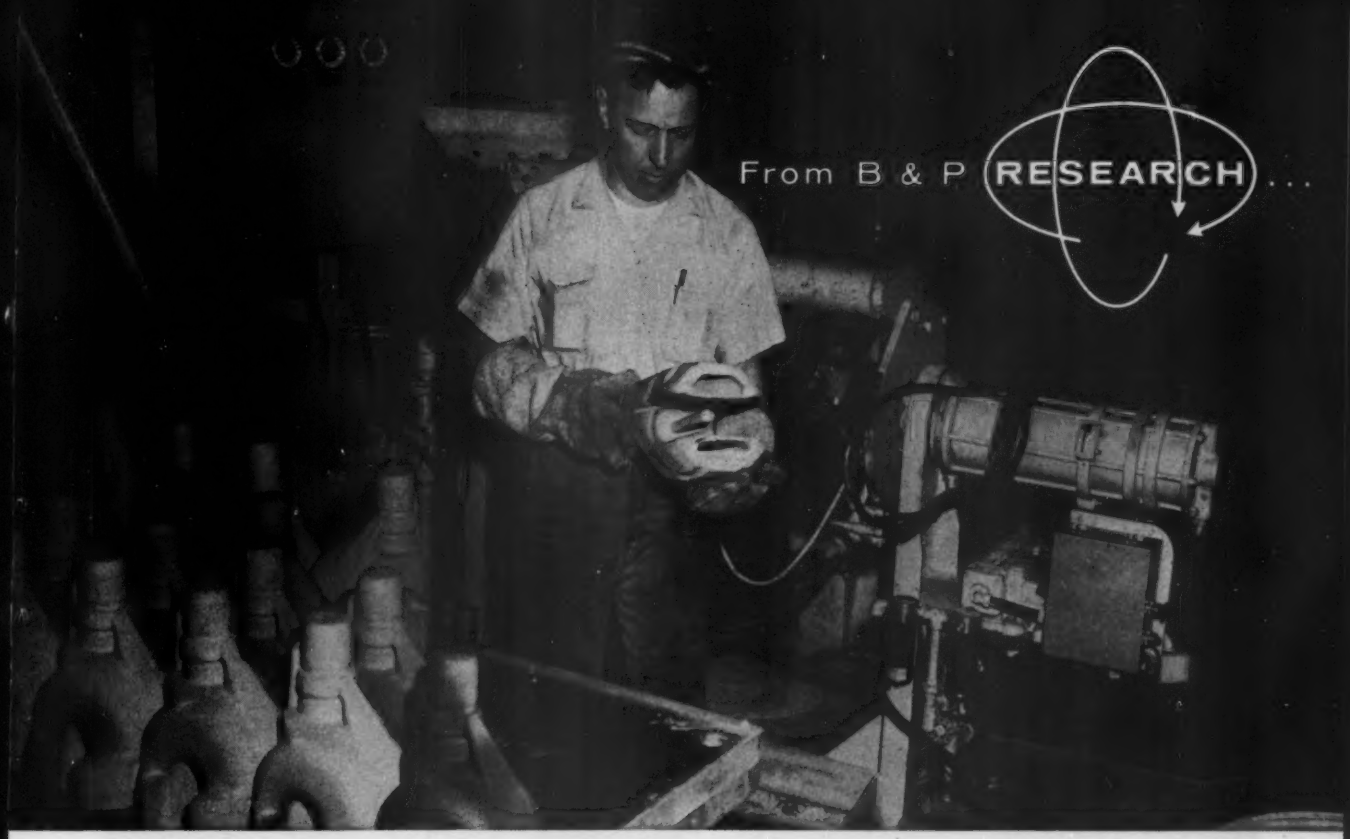
. . . joins Despatch Oven Co.

ROSS S. PETERSON

. . . joins Sperry Products

QUIGG LOHR

. . . American MonoRail v. p.



...THE ONE HOLLOW SHELL CORE UNIT THAT OFFERS MORE

More productivity, more flexibility, more real value for your equipment dollar—that's the B&P Cormatic. The SF6-BA Automatic Hollow Shell Core Machine eliminates guess work. Precision, foundry-proved timers control each phase of the cycle and a single push of a button actuates the entire cycle. In addition to built-in skill, B&P engineers have provided the highest B.T.U. output and precision heat control for fastest, most uniform curing. All Cormatics, of course, feature famous B&P ruggedness and dependability.

Three automatic Cormatics are easily attended by one man and provide up to 240 cycles per hour for outstanding productivity at lowest cost. Even three different size cores with different production time cycles can be produced at top efficiency. No necessity to slow the whole operation because one core requires a longer curing cycle. Box changes can be made on one unit without affecting the high productivity of the other units.

The SF6-B, a low cost, easy to operate Cormatic with operator-actuated valves is available where the higher productivity of the automatic Cormatic is not required.

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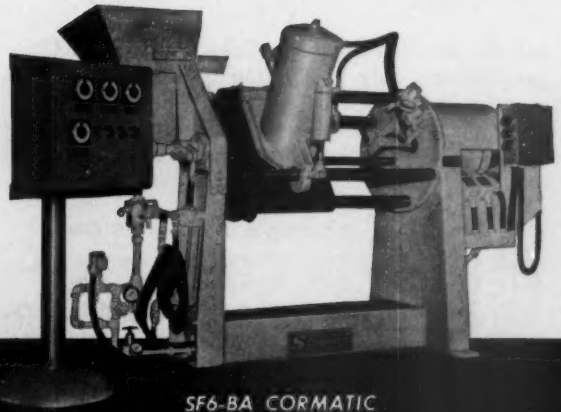


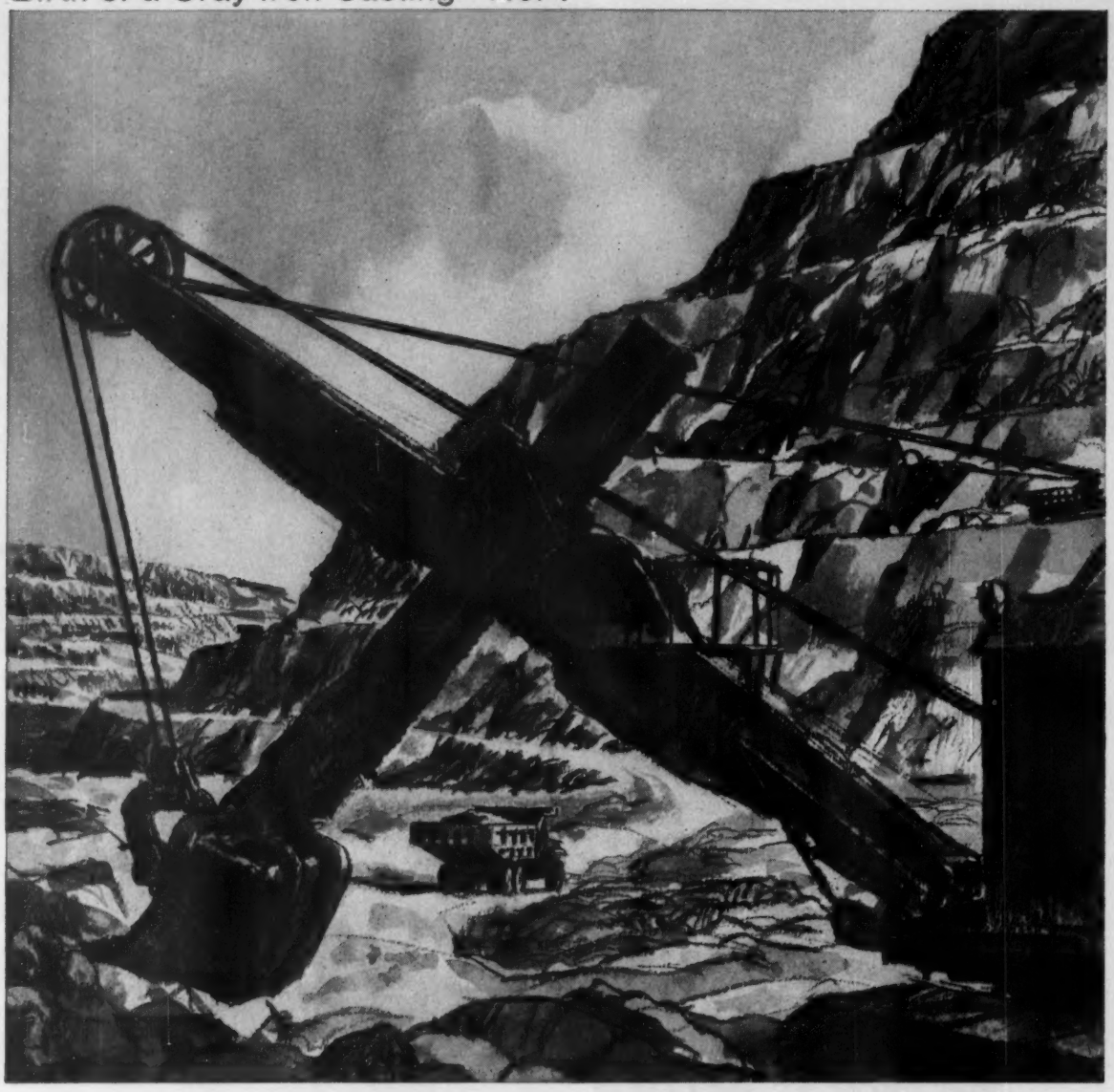
SF6-BA CORMATIC

BEARDSLEY & PIPER

Div. of Pettibone Mulliken Corp.

2424 N. Cicero Ave., Chicago 39, Illinois

Birth of a Gray Iron Casting—No. 1



SELECTION OF ORES

From the great ore ranges in the Lake Superior Region and from other important deposits in the United States, Canada, South America and Europe come high quality iron ores . . . the basic ingredients of fine gray iron castings.

The famed "Mesabi" Range is probably the best known iron ore site in the world. It extends over 100 miles along Lake Superior in Northern Minnesota. Although mined extensively for over a half century, the Mesabi is still producing millions of tons of ore every year.

From this source and from sites located throughout the world, Pittsburgh Coke & Chemical Company selects only virgin iron ores to provide the foundry industry with Neville Pig Iron in a wide variety of analyses. The multitude of gray iron castings produced by these foundries play an essential role in the industrial growth of the nation today.

COKE & IRON DIVISION
PITTSBURGH
COKE & CHEMICAL CO.
GRANT BUILDING PITTSBURGH 19, PA.

Neville Pig Iron and Neville Coke for the Foundry Trade

RICHARD R. KIRSOP
. . . Thiem sales, Wisconsin

STANLEY E. BACON
. . . regional sales mgr.

ROGER J. METZLER
. . . assistant to gen. mgr.

Lohr is president of Canadian Mono-Rail Ltd., the Canadian subsidiary, which recently moved into a new plant in Brampton, Ont.

Richard R. Kirsop has been appointed Wisconsin sales engineer, Thiem Products Inc., Milwaukee. He has worked in the service department and laboratory of the company for several years.

Edward D. Gorton has been appointed eastern regional sales manager for the tractor shovel line of Yale & Towne Mfg. Co., with headquarters in Batavia, N. Y. **Samuel S. Rockwood** has been named western regional sales manager for the line, with headquarters in Portland, Oreg.

Charles A. Evans has been named general sales manager, Beryllium Corp., Reading, Pa. He was with Aluminum Co. of America, Pittsburgh, for 25 years.

Robert J. Olmscheid has been named abrasive specialist in the midwest sales area for Bay State Abrasive Products Co., Westboro, Mass. He recently completed the company's factory training program.

Stanley E. Bacon has been appointed midwestern industrial sales manager, Behr-Manning Co., Troy, N. Y., Div. of Norton Co., Worcester, Mass., with headquarters in Chicago. Formerly divisional manager in St. Louis, Mr. Bacon succeeds **Arthur W. Bell**, who will continue to handle several national accounts in the Chicago branch.

Roger J. Metzler has been named assistant to the general manager, Metals & Refractories Div., Howe Sound Co., Philadelphia. He formerly was marketing manager of WaiMet Alloys Co., Dearborn, Mich., a division of Howe Sound.

William C. Hughes has been appointed safety supervisor for the Portland, Oreg., operations of ESCO Corp. He replaces **Arthur W. Nelson**, who retired recently after 26 years with the company.

CHARLES A. EVANS
. . . joins Beryllium Corp.

ROBERT J. OLMSCHEID
. . . Bay State abrasive sales

WILLIAM C. HUGHES
. . . safety supervisor

JOY Limberoller® idlers outlast steel idlers ten to one in foundry operations

Conventional steel idlers have four bearings under the belt where they can clog up with foundry sand and "freeze," eventually causing ripped belts. Joy Limberoller belt conveyor idlers have just two bearings, one at either end, supporting a neoprene-covered steel wire cable. Neoprene discs are molded to the cable, and the swedged shank ends of the cable fit into bearings. The entire unit revolves on its own axis in these end-mounted bearings.

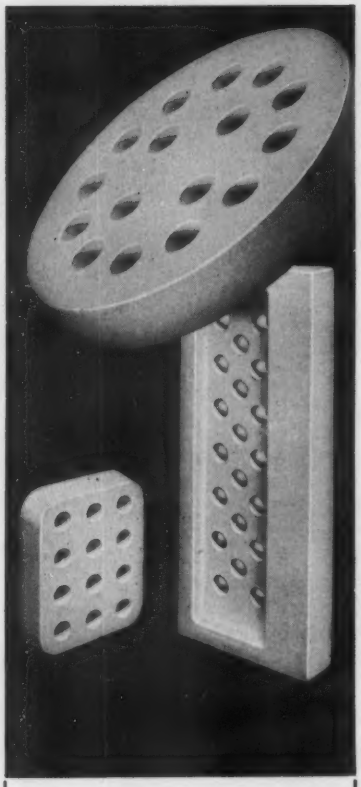
Spilled foundry sand can't possibly get into the bearings because they are up out of the dirt. The bearings may be of the permanently lubricated type so that inspection and greasing are eliminated entirely. Many foundries that have standardized on Joy Limberollers have removed them from their maintenance records. You can make a trial installation simply by putting Limberollers on your present conveyors . . . conversion is quick and easy. Get the complete story by writing for bulletin 2746-13.

JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

Circle 667 on Page 39



Louthan strainer cores cut foundry costs

You minimize casting problems, get cleaner castings when you use Louthan *refractory* strainer cores. Now available in more sizes and shapes—and for steel, iron, brass and bronze castings. All provide an accurate choke for positive control of metal flow, eliminate slag and oxide inclusions.

Write for Free Gating and Risering Refractory Folder. Complete file of specifications on all Louthan products.

LOUTHAN

EAST LIVERPOOL, OHIO

A UNIT OF FERRO CORPORATION

Refractories Division

Circle 668 on Page 39

Maintenance Society Forms, Elects First President

International Maintenance Institute has been organized as a non-profit society devoted to industrial maintenance. Newly elected first president of the institute is George J. Martin, authority on maintenance problems and solutions, writer, lecturer, and consultant.

Aims of the institute are to act as a clearing house for information, to disseminate technical knowledge, and to deal with practical problems and solutions in the whole field of industrial maintenance. As

part of its activities, the institute will hold seminars, conferences, and regional chapter meetings.

Membership in the institute is open to accredited maintenance managers, supervisors, and key maintenance personnel. Interested persons are invited to write to the institute at International Headquarters, Box 409, Greenwich, Conn.

Fluid Power Association Publishes Two Booklets

National Fluid Power Association has published a *Dimension Identification Code for Fluid Power Cylinders* and the second edition of *Glossary of Terms for Fluid Power.* The identification code book contains standards for location of base points and dimensions of fluid power cylinder diagrams, and a code of letters for designating dimensions.

Recommendations cover the various types of mountings and can be applied to all cylinders. The glossary of terms contains 389 fluid power terms and definitions. The cost of these booklets is $1 each. They can be obtained from National Fluid Power Association, 5595 N. Hollywood Ave., Milwaukee 17, Wis.

product defects

getting you down?

let us help you . . .

- ***find hidden cracks*** with magnetic particle or dye penetrant inspection equipment
- ***find deep-lying defects*** with x-ray or gamma radiography equipment
- ***see "innards" directly*** with bright-image fluoroscopes
- ***work out the method*** at our Industrial Applications Lab

call any local Picker office

where a technical expert is always near (see 'phone book) or write

Picker x-ray

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IMMEDIATE DELIVERY

Circle 670 on Page 39

New Grinding Wheel Standards Are Available in Booklet

American Standards Association has approved new standard specifications for shapes and sizes of grinding wheels and has published them in "American Standard Specifications for Standard Shapes and Sizes of Grinding Wheels, B74.2-1960." The publication is intended as a guide for the manufacturer, the consumer, and the general public.

The new standards classify, according to 12 end-use categories, the shapes and sizes of grinding wheels considered standard by industry. A shape and size of a wheel has been included only after determination on the basis of sound engineering practice whether or not it was designed, dimensionally, to perform the particular grinding job for which it was intended.

A free copy of the publication may be obtained from the Grinding Wheel Institute, 2130 Keith Bldg., Cleveland 15, Ohio.

Supervisors' Training Courses Will Be Offered at Purdue

Eight different training programs for foremen, supervisors, and middle management personnel will be offered on campus by the Supervision Institute, Purdue University. Each program will consist of two and one-half days of intensive study which includes 15 hours of instruction.

Programs offered and their dates are as follows: "The Supervisor and His Job," on April 5-7, May 3-5, and May 24-26; "The Supervisor and People," on April 19-21, May 17-19, and June 7-9; "The Supervisor as an Instructor," on March 20-22, May 1-3, and June 5-7; "Making Conferences and Meetings Effective," on March 8-10; "The Supervisor and Methods Improvement," on April 17-19 and May 22-24; "Creative Thinking Techniques in Supervision," on March 6-8; "Improving Supervisory Communications," on April 3-5 and May 15-17; and "The Dollars and Sense of Supervision," on March 22-24. One program, "The Supervisor and People," will be offered in a special class for office personnel on March 29-31.

Introducing

A COUPLE OF SMOOTH OPERATORS

For a better finish start with AMASTEEL **SHOT AND GRIT**
GENUINE ELECTRIC FURNACE STEEL ABRASIVES

ALLOY METAL ABRASIVE COMPANY
ORIGINATORS OF CAST STEEL SHOT
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HERE IT IS IN BLACK & WHITE

that Security's **Pre-Alloyed Furnace Charges** cost less than their original components. *Proof that in each one-thousand-pound heat in an induction furnace,* **Pre-Alloyed Furnace Charges** *will save you money.*

TYPE 304 STAINLESS VIRGIN COMPONENTS		
5 Lbs.	Manganese	$ 1.75
5 Lbs.	Silicon	.95
265 Lbs.	Ferro-Chrome 70%	64.00
90 Lbs.	Nickel	66.60
1.5 Lbs.	Calcium/Silicon	.39
635 Lbs.	Ingot Iron	47.78
		$181.47

TYPE 304 STAINLESS PRE-ALLOYED FURNACE CHARGES
1000 LBS. $.14 LB. $140.00
*Average price for type 304 paid first half year 1960

This comparison reveals a charge savings in excess of $40.00. Think of the additional savings in reducing the necessity of multiple purchase orders, freights, handling and storage. Time consuming **Charge Make Up** is eliminated also because Alloying has already been done for you.

For more information on type 304 Stainless Steel or other Nickel Alloys Contact
FOUNDRY DIVISION

SEND FOR FREE POCKET-SIZE ALLOY SLIDE CHART
Complete analysis of over 100 nickel-cobalt alloys

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3100 West 49th Place, Chicago 32, Illinois

Circle 672 on Page 39

hold metal
longer
without
ladle
distortion

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TYPE 592 ICT

HOLDS METAL ALMOST 3 TIMES AS LONG as is possible in open ladles. Delivers accurate performance even after a full day of heavy production pouring with no cooling time. No binding from heat distortion of ladle bowl. Cuts costs on operations of every size.

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Industrial
EQUIPMENT COMPANY
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Circle 673 on Page 39

OBITUARY

E. Ray Crosby, 70, for almost 20 years an engineer with Smith Facing & Supply Co., Cleveland, died Jan. 21. He retired two years ago. After graduation from Purdue University in 1917, he joined Aluminum Castings Co., now Aluminum Co. of America, and worked in the company's Detroit and Cleveland plants. Later he was with Allyne-Ryan Foundry Co., Cleveland.

William Finneran, Chicago district sales manager, Welding Products Div., A. O. Smith Corp., Milwaukee, died recently. He joined the company in 1951 and was transferred to the Chicago office in 1954.

Merton W. Zeman, 74, formerly director of sales, engineering, and research, Osborn Mfg. Co., Cleveland, died Feb. 8. He joined the company in 1912 as a designer in the molding machine division, and entered sales in 1914. He became director of European sales in 1919, and in 1923 was made sales manager of the machine division, directing sales in the United States and abroad. Appointed head of sales, engineering, and research in 1939, Mr. Zeman retired in 1945.

Fred E. Canfield, 60, owner and operator of Fred Canfield Foundry Sand Co., Kansas City, Kans., died Jan. 7. He was a charter member of Mo-Kan Chapter of the American Foundrymen's Society.

Edward L. Hanson, 60, vice president of manufacturing, Frank G. Hough Co., Libertyville, Ill., died Jan. 11. He had been with the company for 20 years.

William E. Hall, 84, chairman of the board and cofounder of Duriron Co., Dayton, Ohio, died Jan. 23.

Paul Pigott, president, Pacific Car & Foundry Co., Renton, Wash., died Jan. 23. Mr. Pigott had been president of the company since 1934.

Cut Your Costs And Save Your Patterns With Arrow Butts And Peins . . . featuring replaceable rubber tips.

Over one half million have been used with complete satisfaction. Send for catalog on complete line of butts and peins. We feature 13 types. Sand rammer butts are our business, not our sideline.

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WEIGHTS FROM 1 TO 60 LBS.
WE ALSO MAKE SHOT AND NOTCH BAR

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Aluminum
EY-BAR
TRADE MARK

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Phone: MElrose 1-5435 and 1-5436

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Specify precisely alloyed, trouble-free

Federated bronzes

Federated precisely engineered bronzes are produced by highly perfected alloying techniques and rigid quality control procedures developed at Asarco's Central Research Laboratories.

Result: Fewer rejects and more uniform castings. For best foundry performance, specify these high tensile bronzes:

HERCULOY SILICON BRONZES — Tough — even among the toughest bronzes. Excellent fluidity, tensile strength up to 65,000 psi, yield strength up to 35,000 psi.

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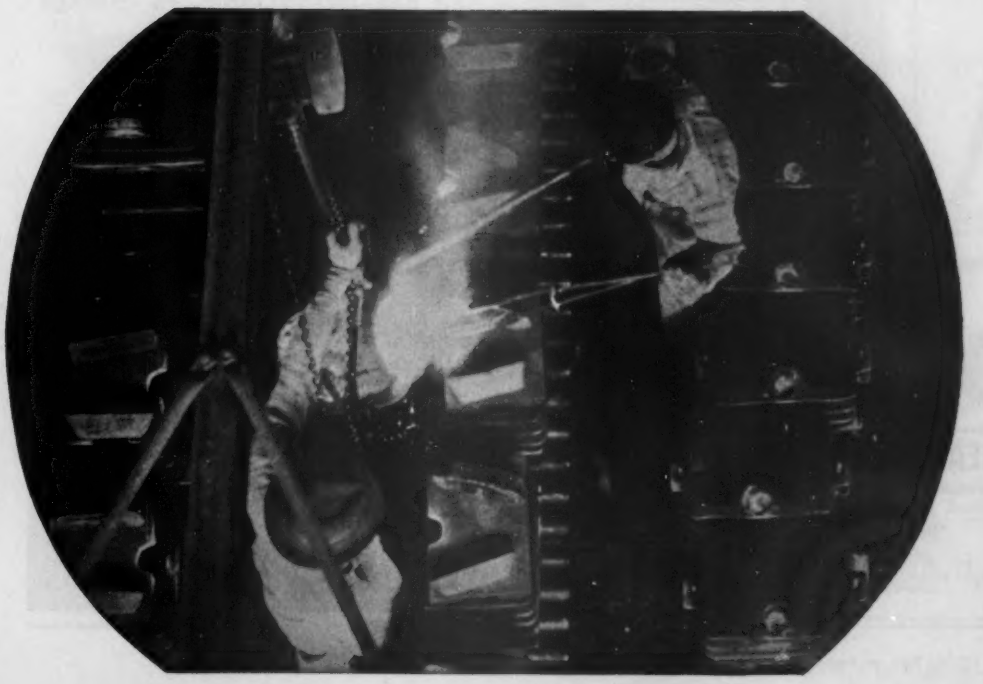
For complete data on these bronzes, write on your company letterhead for your copy of 60-page handbook "Brass and Bronze Casting Alloys." Write or call Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, N. Y., or your nearest Federated sales office.

ASARCO



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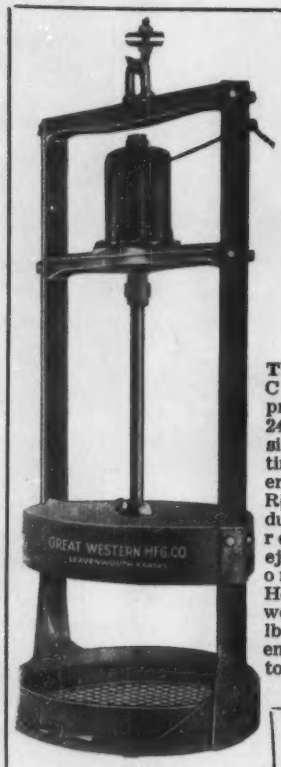
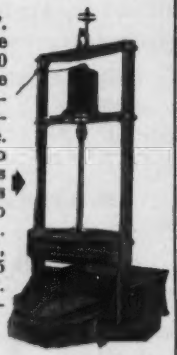
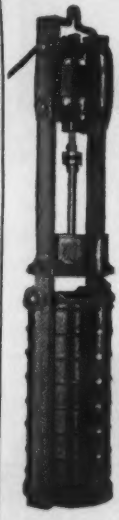
"Greatest Name in Motion"



TYPE "CS". Complete price $435.00 24" square sieve. A continuous operation sieve. Requires no dumping, as refuse is ejected off to one side. Height 4'10", weight 295 lbs, ⅓ H.P. enclosed motor.



TYPE "CR". Complete price $425.00. 24" dia. round sieve. Sifts, fluffs, mixes, aerates sand. Height 4'6", weight 250 lbs., 1/3 H.P. enclosed motor.



TYPE "HL". Price $315.00 complete, less sieves. Laboratory model especially designed for laboratory sand control, fitted with 1/6 H.P. enclosed motor.

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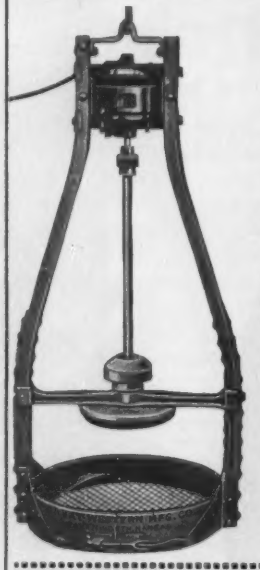

TYPE "V". Price, 20" Sieve, $330.00. Does the work of 10 men. Screens sand, Fine, Medium, and Coarse. 20" dia. sieve with special clamp for 5-second changes. Height 4'6", weight 100 lbs., fully-enclosed 1/6 H.P. motor. Also available in Giant V-5 with 36" sieve for triple capacity . . . Price $600.00.

MAIL THE COUPON NOW!

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Worried about REJECT LOSSES?

MOGUL®

HIGH VACUUM IMPREGNATING

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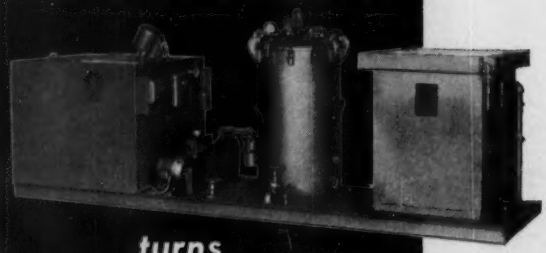
porous castings

into

DEPENDABLE PRODUCTS



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Permanently seals leakers and weepers in ferrous and non-ferrous pressure castings

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"PACKAGED" MOGULLIZING UNIT with extremely high vacuum (29" or more) READY TO INSTALL.

Complete unit ready for immediate use, hooks up to your utilities, saves costly installation. Removes ALL air and moisture from casting to be sealed. Assures *positive impregnation* of the most minute porosity by powerful vacuum action, further intensified by use of air pressure.

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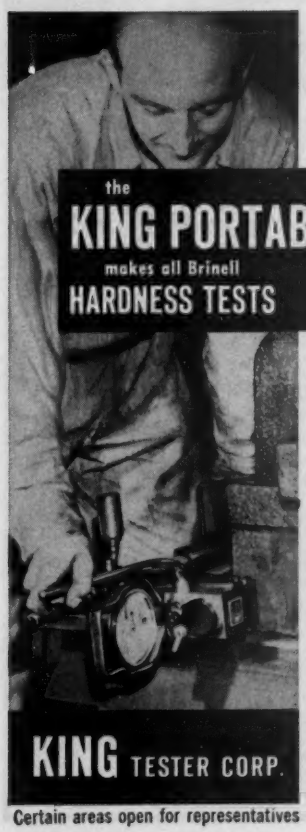

any size, shape or thickness..

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Round, flat or unusual shapes or sizes are no problem to test with the King Portable. Rugged—lightweight, it tests metals from softest leads to toughest alloys having over 700 BHN. And it can be used anywhere, accurately!

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CYLINDER LINERS FOR HIGH PRODUCTION

MODEL MLS

ONE MAN OPERATION
METALLURGICALLY CONTROLLED METAL

Pneumatic control system—Measured molten metal—Timed spin—Automatic spraying—Sturdy construction for continuous operation by unskilled labor.

This is only one of many machines designed for high production of better castings, made centrifugally. Technical advice and mold design service available to all customers.

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plastic mold and core duplications save time and labor

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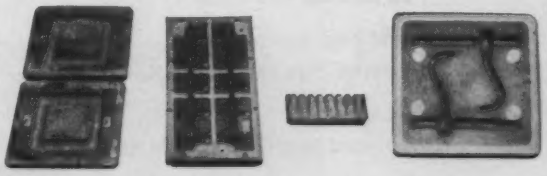
4 PLASTIC PATTERN APPLICATIONS



A few of more than twenty patterns, duplicated from plaster casts by Wolverine Brass Works, Grand Rapids, Michigan, using REN plastic compounds. Comparison analysis proved Wolverine saved up to 66% in construction time—and up to 80% in labor using REN epoxy resins for these patterns.

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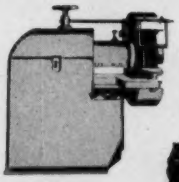

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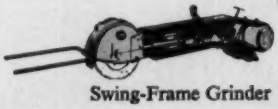

Swing-Frame Grinder

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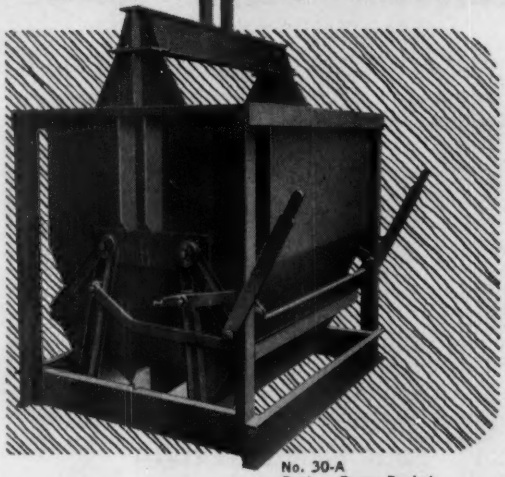
PENN BUCKETS



No. 30-A
Bottom Dump Bucket

Exclusive design makes this bottom dump bucket easy to operate . . . easy to open. Efficient for foundry use in handling all types of sand, moulding or core, dry or prepared. Can be used with coke, scrap iron and castings also. Sizes 7 to 200 cu. ft.

Write Today for Catalog • Prices Quoted on Application

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Inspected at 7 points of manufacture for highest possible matchplate quality . . . Scientific is the only producer using patented new Fortschneider Shift Indicator.

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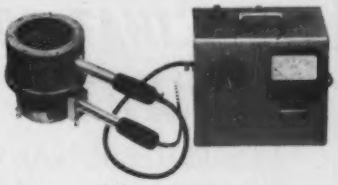
Hydrogen Content Control
REDUCES REJECTS
with
One Minute
Foundry
Test



Rejection of aluminum alloy castings, due to porosity, can be reduced through the use of one or more "HYCON TESTERS" in your foundry. The MEL model 5203 HYCON TESTER uses the "Initial Bubble Principle" to determine hydrogen gas content in molten aluminum alloy to an accuracy as close as ±0.05 ml H_2/100g. Immediate and accurate control is thus available *before* casting. A simple operation requires but a minute. A small amount of molten alloy is ladled into the pre-heated electric crucible and pressure reduced at a controlled rate. When first bubbles break surface, temperature and pressure are noted and referred to a nomogram for precise hydrogen content reading.

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Deliver Better Metal Faster!

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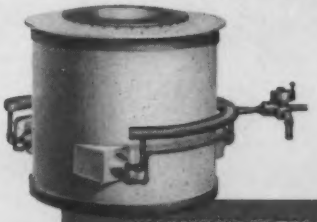

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These furnaces are highly recommended as breakdown furnaces for zinc and aluminum die casting and permanent mold plants. They also excel as holding furnaces. They can be supplied either with or without hoods to exhaust fumes and heat. Their construction assures longest pot life and lowest fuel costs. Choice of automatic or manual controls and oil or gas fire. Capacities from 50 to 9000 lbs. aluminum; 125 to 23,000 lbs. zinc; other white metals corresponding.

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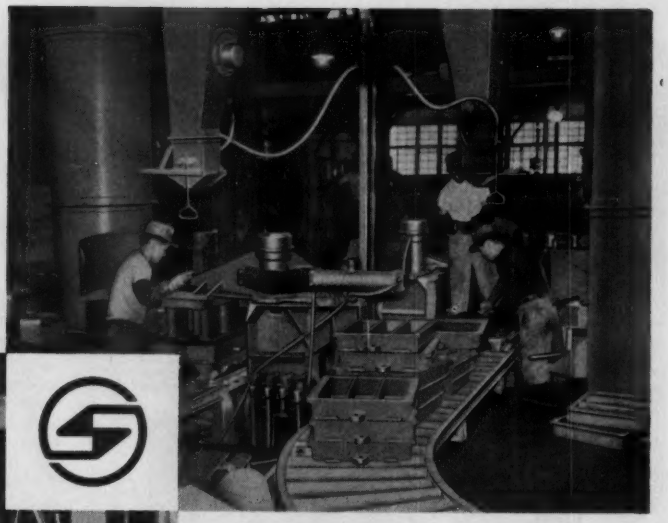

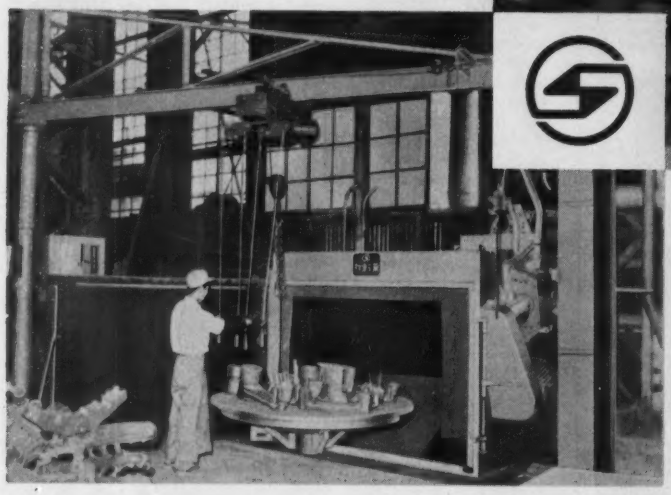

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Sand Preparing Machines
Shot Blasting Machines
Mechanized Foundry Equipment

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MURPHY PISTOL SPRAYER guaranteed

2922

Forces blackening into pores and pockets of molds. Sprays silica wash, oil, or water equally well. Used also to sand blast, to clean automobile and diesel engines, to spray centrifugal molds. Standard of the foundry field for more than 50 years. Priced from $17.25. Write for quantity discounts.

(Also furnished in a deluxe model with air pressure reducing valve, 20' of air hose, and 5' of suction hose, both of superior quality, oil and acid resisting plastic.)

Ask your foundry supply dealer or —

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PLANT REMODELING . . PLANT DESIGN . . CONTINUOUS SYSTEMS . . . SEMI-CONTINUOUS SYSTEMS . . . PRESENT OPERATION MODERNIZED

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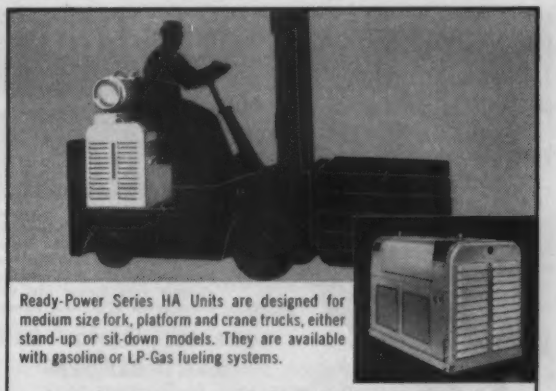

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CORE WORK, SAND FACINGS, SPRAYS

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HAVE YOU TRIED **SAND BLASTING?**

SAVE up to 75% on required man hours for rust removal, scale removal, or metal finishing. SAVINGS on your first few jobs can pay for this amazing portable sand blaster that delivers up to 50% more power.

NEW

PORTABLE "SANDY JET" SAND BLASTER

Model B

- Needs no separate blasting room.
- Light weight rugged construction.
- New pistol-grip for easy operation.
- Uses any easily obtainable abrasives.
- Three sizes of interchangeable sand nozzles and air jets, available to suit any job.
- Fast, intense, powerful, cutting action.
- Operates efficiently on 50 to 225 lbs. air pressure.
- Abrasive container holds 60 pounds of sand.

LOW COST

★ 10 day money back trial offer. Complete with face shield, operators' hood and two extra nozzles.

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BRASS & BRONZE FOUNDRY PRACTICE
By Harry M. St. John

The 250 pages of this book cover the entire range of brass foundry operations. The text is supplemented by 95 illustrations which clarify and enlarge on the subject matter. A complete index expands the usefulness of the book as a reference work.

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International Foundry Supply Co., P. O. Box 1053, Reading, Pa.

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A RELIABLE SOURCE
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40th YEAR AT THE SAME STAND

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We are proud of the results obtained for our foundry clients.
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HIGH QUALITY • LOW ALUMINA

FINELY GRADED TO DESIRED SIZE

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SAND PREPARATION • MECHANIZATION • PLANT LAYOUT

Circle 698 on Page 39

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Published by the Malleable Founders Society, this new 526-page handbook reflects the authoritative knowledge of the malleable industry's foremost foundry technicians and casting designers.

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Please add 3% to cover state sales tax for deliveries in Ohio. (This volume is also available from our London office, 2 Caxton St., Westminster, London, S.W. 1, England)

Circle 699 on Page 39

CLASSIFIED ADVERTISING

• HELP WANTED

FOUNDRY FOREMAN

To assist foundry superintendent in managing foundry operations; 100 employees producing squeezer machine small gray iron, some floor work and various alloy castings, all of electric arc melt. This position is permanent with opportunity of promotion to foundry superintendent in near future. Must be experienced in gray iron molding and have metallurgical degree or equivalent training.

A progressive manufacturing company with captive foundry located in Maryland. Salary open depending on experience. Fringe benefits above average, with noncontributory surgical, hospitalization and profit sharing program. Submit complete resume and desired salary.

BOX 789, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY SUPERINTENDENT

Experienced foundry supervisor to take complete charge central Pennsylvania iron foundry, preferably with meehanite and heavy pit experience—knowledge scheduling—quality control—gating and risering. Casting size from 5 pounds to 40,000 pounds. Send resume and salary required in confidence to:

BOX 792, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

BENDIX FOUNDRIES

Opportunity

for

Technical Director

in

Magnesium and Aluminum

Foundry

Responsible for metallurgy

engineering and research

BENDIX FOUNDRIES

THE BENDIX CORP.

ECLIPSE PIONEER DIVISION

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TETERBORO, NEW JERSEY

SUPERINTENDENT

SMALL GRAY IRON FOUNDRY NEAR CHICAGO. MUST HAVE EXPERIENCE IN MOLDING AND MELTING OF GRAY IRON AND DUCTILE. MUST HAVE RECOMMENDATIONS. ADDRESS: BOX 790, FOUNDRY, PENTON BLDG., CLEVELAND 13, OHIO.

APPLICATION ENGINEERS

Graduate engineers experienced in the design and use of gas or electric heat treating furnaces or ovens. Opportunity for advancement to Product Manager or Sales Engineer. Write giving experience and qualifications to: Box 797, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PRODUCT MANAGER

Man experienced in design and sale of electric and gas melting furnaces (nonferrous preferred). Some experience in induction melting furnaces desirable. Send resume to: Box 798, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• HELP WANTED

METALLURGIST

With investment casting experience. Forward resume with salary requirements. Location—Philadelphia area. Address: Box 805, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MOLDING FOREMAN

Experience in all phases of gray iron molding, rollover and squeezer, etc. Medium size foundry. Relocate—Middlewest.

BOX 813, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY SUPERINTENDENT
$12000—$14000

For a modern foundry. Will consider top assistant.

FOUNDRY ENGINEER
$9000—$11000

Young engineer looking for assured future. CONTACT PAUL SHELDON in confidence

MONARCH PERSONNEL
28 EAST JACKSON BLVD.
CHICAGO 4, ILLINOIS

FOUNDRY SUPERINTENDENT
STAINLESS, ALLOY AND STEEL CASTINGS

The successful candidate will be responsible for all foundry operations, including pattern shop, core room, melting, molding, cleaning, heat treating, and inspection departments in a 125 man jobbing foundry in Southern Ontario, Canada.

Applicants must have at least 10 years of practical steel foundry experience and demonstrated supervisory and organizational ability. Preferably, candidates should have some experience with alloy steel castings and/or an engineering background.

Salary will be in line with experience.

Age 35—50

Replies, which will be treated in strictest confidence should state age, education, detailed experience and present salary and be addressed to . . .

BOX 796, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

CLEANING FOREMAN

Experience in all phases of gray iron finishing, blasting, etc. Medium size foundry. Relocate, Middlewest.

BOX 779, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY FOREMAN

To be responsible for the operation of a nonferrous foundry, a division of a nationally represented manufacturing company, located in the southwest. Must be experienced in aluminum and brass molding, quality control and melting practices on a supervisory level.

Desire young man in early thirties with trade school background. Excellent opportunity for good Assistant Foreman who wants to move ahead.

Reply should include complete resume, salary desired and references.

BOX 819, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY SUPERVISOR

To take charge of coreroom and squeezer operation in Midwestern steel foundry.

Must know sand and be able to maintain good production.

Average number of employees to be supervised about 30.

If interested, send experience, education and qualifications.

BOX 780, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

• HELP WANTED

FOUNDRY PRODUCTION METALLURGIST

To direct 400-ton-per-day gray iron melting operation in mechanized, Midwest foundry. Must have experience in latest melting techniques, broad and progressive thinking, with good communicating ability. Prefer B.S. Degree, or equivalent, in Metallurgical Engineering. Objective: reduce costs and upgrade quality. State salary requirements.

BOX 814, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY ENGINEER

Needed immediately, experienced, inventive, Foundry Engineer for nonferrous foundry (Bronze & Aluminum). Sand, permanent and centrifugal molding, core making and cleaning departments. Sand laboratory and powder metal manufacturing. Strong mechanical background necessary. Salary open. Reply by resume in confidence to . . . Address: Box 793, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• POSITIONS WANTED

GRAY IRON METALLURGIST

Basic and acid cupola, technical experience all phases of foundry operation, production engineering, available, age 49. Address: Box 824, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT-MANAGER

Progressive, practical and technical trained in all phases of ferrous and nonferrous jobbing and production foundries. Twenty-two years as top supervisor. Quality and cost minded. Good trouble shooter. Age 47. Now employed. Address: Box 806, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

ASSISTANT MANAGER OR SUPERINTENDENT

Graduate foundryman with diversified experience in gray iron foundry operations, progressive, resourceful, cost and quality minded, now employed, wishes a challenging post with a production shop planning to improve operations and expand. Address: Box 786, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MELTING FOREMAN—MELTER

Steel foundry, electric arc furnaces, basic or acid practice. Carbon, alloy and stainless steels. Capable of taking full charge, including budget and incentive systems. Address: Box 823, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MACHINE DESIGNER

Thoroughly experienced in design and application of Coreroom machinery, desires connection with progressive manufacturer for development of new jobbing foundry core machine unit. Address: Box 809, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

INCENTIVES SUPERVISOR

Young man with a ten year background in developing and supervising foundry incentive plans desires a position with a progressive foundry organization. Address: Box 800, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT OR MANAGER

Thirty years' experience in all phases of malleable iron, pearlitic malleable, light and medium gray iron. Have knowledge of stack molding. Well versed in pattern layout, gating, feeding of malleable, mixing and melting in air furnace and cupola. Sixteen years — foreman and superintendent: Fourteen years as superintendent on present job. 49 years old. Married. Can furnish excellent references. Address: Box 799, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PRACTICAL AND TECHNICAL FOUNDRYMAN

With good profit record would like to make change. Will relocate. Address: Box 803, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MANAGER-SUPERINTENDENT

Age 45. 30 years' experience in all phases of gray iron foundry. Proven ability in ductile and high strength gray irons, basic and acid cupolas, jobbing or production. Address: Box 801, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PROFIT—DOMINATED

Hard-driving and versatile foundryman desires demanding position as manager's assistant or superintendent. Fourteen years of diversified gray iron jobbing and production experience. Journeyman. Engineer graduate with added business education. Young familyman. Will go anywhere.

BOX 802, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

• POSITIONS WANTED

ENGINEER

YOUNG ENERGETIC MELTING FURNACE ENGINEER WITH FIFTEEN YEARS' EXPERIENCE. POSSESSING THE PATENT AND DESIGN RIGHTS, HAVING BEEN ACTIVELY ENGAGED IN THE RESEARCH AND DEVELOPMENT, OF THE "CUPOILA", THE ONLY OIL FIRED CUPOLA AND FERROUS MELTING CUPOLA IN THE WORLD. DESIRES PROGRESSIVE POSITION WITH SUBSTANTIAL FIRM TO DEVELOP THE "CUPOILA". ALSO NONFERROUS FURNACES FOR THE UNITED STATES MARKET AND FOR EXPORT. ADDRESS: ROY HALL, DENTON CORNER, NEWHAVEN, SUSSEX, ENGLAND.

ATTENTION!

If you are looking for an additional gray iron product to add to your operation to help outride your overhead and have capital to build inventory, I can furnish you Pattern Equipment. Desire position with company and percentage on sale of product under contract. Prefer an Ohio Location. Cored work. $200,000 yearly sales. Address: Box 781, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERVISOR

Experienced molding and core room supervisor in steel and iron (Meehanite). Production or jobbing; knowledge of gating, risering, production control, CO_2 and cold set core making. Complete foundry background. Age 37. Address: Box 825, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERVISOR

Twenty-five years in supervision, experienced in gating and sampling, squeezer, cope and drag work. Prefer malleable job shop. Will relocate. Address: Box 808, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Technically, practically and administratively experienced in producing grey iron, ductile, malleable and steel. Presently employed. Will consider overseas assignment. Address: Box 807, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MANAGEMENT ASSISTANT

Experience in all duties of management including time-study and incentives. Aluminum and gray iron foundry experience. Resume sent upon request. Address: Box 811, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MOLDING FOREMAN

Twenty years' EXPERIENCE in steel foundry. Floor molding and machine molding; Bumpers or slingers. All types castings to 20 tons. Address: Box 816 FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT OR MANAGER

Practical foundryman, nationally known for a job well done. Age 48. Good health. Now employed. Looking for more action ferrous or nonferrous, $15,000 minimum. Address: Box 784, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

INSPECTION-SALES-SERVICE

20 years' experience all phases steel casting and machining. Especially diesel locomotive and subway truck frames. Exceptionally qualified on service and customer contact. Will travel anywhere. Address: Box 821, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY MANAGEMENT

Young man possessing B.S. Metallurgical Engineering, MBA Production Management. Two years' experience gray iron and steel foundries. Desires Ohio, Pennsylvania, New York, New Jersey area. Address: Box 810, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRYMAN

Experienced in gray iron and nonferrous metals, mechanization, design, patternmaking, gating, risering, costs. Presently employed as pattern supervisor. Address: Box 785, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOREMAN

20 years' experience in all phases of steel foundry. Supervised floor, bench, squeeze and machine molding. Assisted and installed incentive programs; also experienced in job evaluation. Address: Box 820, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PERMANENT MOLD ENGINEER

Experienced in all phases of mold design and operation. Graduate engineer with broad nonferrous background. Address: Box 826, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT—GENERAL FOREMAN

Practical and technical; presently employed in the East; over 30 years' experience; jobbing or production to 5 tons. Address: Box 804, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PERMANENT MOLD DESIGNER

Fully experienced in Aluminum and Magnesium mold design and operation. Available in New York City and New England area. Address: Box 795, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• EMPLOYMENT SERVICE

FOUNDRY PERSONNEL SPECIALISTS
National Placement and Procurement of
GENERAL AND PLANT MANAGERS, PLANT SUPERINTENDENTS, FOREMEN—ALL DEPARTMENTS, METALLURGISTS, ENGINEERS, CONTROLLERS, ACCOUNTANTS, SALESMEN, SALES MANAGERS, PERSONNEL DIRECTORS, PURCHASING AGENTS
Confidential Inquiries Invited
From Employers and Qualified Applicants
For Fast Competent Assistance Contact
DRAKE PERSONNEL, INC. **FINANCIAL 6-8700**
JOHN COPE, DIRECTOR, 29 E. MADISON ST., CHICAGO 2, ILL.

• POSITIONS WANTED

FOUNDRY EXECUTIVE

Thoroughly experienced in the management of gray iron production or jobbing foundries. Qualified to show you a highly efficient operation. Address: Box 817 FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

STEEL FOUNDRYMAN

Thirty-seven years' experience in foundry jobbing and production; twenty-five supervisory. All phases: Quality control, molding, melting, coremaking, cleaning, heat treating, gates and risers, sand mixtures—carbon, alloy, and stainless steels—pressure castings. Now available. Address: Box 812, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• REPRESENTATIVES WANTED

HELP WANTED

Lucrative Sales Position open with leading manufacturer of foundry products. Must have recent or current experience in successful dealings with purchasing and metallurgy foundry personnel in Ohio. Please state sales background, availability, education and salary requirements. Manufacturer's representative will be given consideration if coverage of Ohio is adequate and no lines conflict. Address: Box 778, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

CENTRIFUGAL CASTING EQUIPMENT MANUFACTURERS REPRESENTATIVE

Must be familiar with centrifugal casting process. Prefer man that now represents suppliers of foundry equipment. Write DEPCO, P.O. Box 7466, Tulsa 9, Oklahoma.

MANUFACTURERS REPRESENTATIVE

New accounts desired for reputable gray iron foundry producing high quality castings in the light weight range. Iowa and neighboring states area. Address: Box 794, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• CONSULTANTS

FOUNDRY CONSULTANT—NONFERROUS

Sand casting—permanent mold casting—centrifugal castings—in aluminum, brasses, bronzes, 30% leaded bronze—aircraft quality bearings and castings. Address: ED JENKINS, West Palm Beach, Florida. PHONE: TEMPLE 2-8685.

BRASS FOUNDRY CONSULTANT AND METALLURGIST

Specializing in brass and bronze foundry economics. HARRY ST. JOHN, 9403 So. Indian River Drive, Fort Pierce, Florida. Phone: HOward 1-2505.

CONSULTANT

In foundry operations and engineering gray iron, malleable iron and steel. Address: HERBERT F. MILLER, 589 Trade Winds Drive, Dunedin, Florida.

• FOUNDRIES WANTED

FOUNDRY WANTED

GROUP OF FOUNDRY ENGINEERS AND INDEPENDENT MANUFACTURERS WANTS TO PURCHASE FOUNDRIES (FERROUS AND NONFERROUS) WITH OR WITHOUT PROPERTY. PLEASE SUBMIT COMPLETE DETAILS AS TO CAPACITY, TYPE OF PRODUCTION, FOUNDRY EQUIPMENT, FLASK INVENTORY.

PRINCIPALS ONLY
ALL REPLIES CONFIDENTIAL

BOX 782, FOUNDRY

PENTON BLDG. **CLEVELAND 13, OHIO**

• FOUNDRIES WANTED

EQUIPMENT WANTED

Large South American Manufacturer wants to purchase complete foundries, without property, for own use. Plants must have large capacities. We are ready to do business as soon as we receive complete details as to price, equipment, inspection, etc. All replies confidential.

BOX 822, FOUNDRY

PENTON BLDG. **CLEVELAND 13, OHIO**

FOUNDRY—WANTED—EQUIPMENT

Foundry investment organization needs used equipment to activate and mechanize a large foundry. Complete foundry with or without property will be considered. Please be specific as to price and when inspection can be made. Principals only. All replies confidential.

BOX 783, FOUNDRY

PENTON BLDG. **CLEVELAND 13, OHIO**

• WANTED-TO-BUY

WANTED TO BUY

Good used basic Lined top charge electric furnace, complete with adequate transformers and switch gear, 10,000 to 12,000 pounds gross melt and pour capacity. Address: SUMNER IRON WORKS, P.O. Box 1006, Everett, Washington.

WANTED

Used Electric Arc Melting Furnace 4-6 Ton & 7-10 Ton Heat Size.

On Furnace, Transformers, Controls and Auxiliaries, Send full description, Specifications, Location and Price in first letter.

STRUCTURAL METALS, INC.

P. O. Box 911 **SEGUIN, TEXAS**

WANTED

Used Laboratory Equipment
Send details To

BOX 791, FOUNDRY

PENTON BLDG. **CLEVELAND 13, OHIO**

• FOUNDRIES FOR SALE

SMALL GRAY IRON FOUNDRY

Modern equipment, nice home included and other extras. Plenty of land for expansion. Detroit, Michigan area low down payment. Opportunity for experienced foundryman. Address: Box 818, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

GRAY IRON FOUNDRY

Pouring 12000 lbs a day, large backlog. $25,000, $10,000 down. Reasonable terms. Includes a house and full equipment located central Pennsylvania. Call New York City, A. Billard, 375 Park Avenue. Phone MU 8-8855.

FOUNDRY FOR SALE

Fully equipped now operating gray iron foundry in Western New York State for sale. Due to illness and age present owners want to retire and settle an estate. Any reasonable offer considered.

BOX 815, FOUNDRY

PENTON BLDG **CLEVELAND 13, OHIO**

FOUNDRY EQUIPMENT

WHEELABRATORS

(1) 20″ x 27″ C/W Dust Collector—Rubber Belt
(2) 27″ x 36″ Rubber Belt C/W Dust Collector & S/H
(1) 27″ x 36″ Steel Flight C/W Dust Collector & S/H
(2) 36″ x 42″ Steel Flight C/W Dust Collector & S/H
(1) 48″ x 72″ Steel Flight C/W Dust Collector & S/H
(1) 1-A-Multi Tables W/8-19″ Tables C/W/D/C
(1) Wheelabrator Skip Hoist—For 27″ x 36″ (Never Used)
(1) Hollingsworth 5 cu. ft.

SAND MULLERS

(1) Clearfield #404 4′ 400# Cap.
(1) Clearfield #610 6′ 1500# Cap.
(1) Beardsley & Piper 3½ Mulbaro
(1) Simpson—1—C—C/W/Skip Hoist. 4′ 500# Cap.
(1) Simpson—#3 UD—8′ 3000 #Cap.
(1) Nat'l Engineering Skip Loader for—Simpson Muller

CORE BLOWERS

(1) Demmler #55—Ser. 2032 C/W Air Clamps.
(1) Redford #4-D-Ser. 4-D-114-60—Coreshoot & Blow. C/W Air Clamps
(3) Redford #2

MISC. FDRY. EQUIPMENT

(1) Model—"M" B/P Screenerator
(1) Stroman—Rev. Furnace—1957—Gas Fired C/W-Controls 600# Aluminum—1800# Brass — Automatic Tilt
(6) Ingersoll-Rand Air Hoist —500# to 10,000#
(6) Budgit Hoist 500#—2000#
(6) Master Bench Rammers 2-BA (Never Used)
Molding machines — Core Ovens—Mold Dryers—Core Machines — Handy Sandys —Shake Outs—and Many other Items—Send us Your Requirements — List your surplus equipment with—

Phone ES-8-5648

FOUNDRY ASSOCIATES

927 S. CICERO
CHICAGO 44, ILLINOIS

Circle 866 on Page 39

• FOR SALE

HYDRO FILTER DUST COLLECTOR
14000 CFM, 25 H.P., 220-440-60-3
Size 11, Type I
WELLS MANUFACTURING COMPANY
MR. J. T. MOORE
7900 NORTH AUSTIN AVE., SKOKIE, ILLINOIS
PHONE: INDEPENDENCE 3-5050

FOR SALE

SIMPSON #2 UD Muller
SIMPSON #2 OG Muller
SIMPSON #1½ OG Muller
SIMPSON #1 UD Muller w/loader
SIMPSON #1½ F Muller w/loader
B & P Mulbaro
CLEARFIELD #404 Muller
OSBORN #276 Jolt Squeezers
OSBORN #275 Jolt Squeezers
SPO #110 Jolt Squeezers
SPO #2114 Jolt Squeeze Pin Lift
J & J #918 Jolt Rollover 44″ x 54″
J & J #815 Jolt Rollover 30″ x 40″
B & P #S, M, L, Screenerators
ROYER 16″ Sanditioner
DETROIT 5 Ton Air Hoist w/trolley
I-R 1000-6000 lb. Air Hoists
PANGBORN Dust Collector 1000 cfm
AMERICAN Wheelabrator Tumblast 27″x36″

PEK MACHINERY COMPANY
P.O. BOX 4146 BERGEN ST. STATION
JERSEY CITY, NEW JERSEY
PHONE: HE 2-4262
BUY—SELL—LIQUIDATE

FOR SALE

SIMPLICITY 2′ x 3′ Screen w/Motor and Starter SAND CONDITIONER—Rebuilt.
WHITING Cupolas—#1 (Unused) #2 (Good) #4 w/Skip Charger, SPENCER BLOWER, all Motors and Starters.
PREPARATOR (B&P) #60—One used less than six months, the other older, both in "A-1" Condition.
MOULDERS FRIEND—60″ w/Extra Brush. Rebuilt and Guaranteed.
OSBORN #275-J Portable Jolt Squeeze, also #559 OSBORN Jolt Pin Lift—Like New.
Write or call—also other equipment
W. O. McMAHON
P.O. BOX 5799 HOMEWOOD STATION
BIRMINGHAM 9, ALABAMA
PHONES: TREMONT 1-2688 AND 9-6170

REPAIR AND REBUILDING SERVICE ON ALL PNEUMATIC TOOLS

We try to carry a complete line of "Hard Chrome Rebuilt Tools" at about half the cost of new tools. Before you discard your old tools, why not send them to us for our estimate on the cost of renewing them with our Hard Chrome Process?

CENTRAL PNEUMATIC SERVICE, INC.
512 LINDEN AVENUE
DAYTON 3, OHIO
PHONE: CL 2-2761

FOR SALE

JACKSON & CHURCH AUTOCLAVE
Vacuum Impregnator—Jacketed
54″ x 72″—150,000 Cu. Inch
Like New
GLOBE TRADING COMPANY
1815 FRANKLIN STREET
DETROIT 7, MICHIGAN

• FOR SALE

C. GREENE EQUIPMENT CORPORATION
GOOD USED
FOUNDRY EQUIPMENT

SPO Model 9546 Jolt, Rollover, Draw, squeeze machine late model
INTERNATIONAL Rollovers 30 x 8
INTERNATIONAL Rollovers 24 x 10
DAVENPORT Rollover model 34A Table 36 x 60
SPO Rollovers
INTERNATIONAL Jolt Pin Lifts all sizes
J & J Jolt Pin Lifts model 812S Table 30x38
SPO Rollover Pattern Draw Model RD 6815 table 36 x 68 draw 15″
INTERNATIONAL Plain Jolt machines
INTERNATIONAL Core Blower SB11
CHAMPION Model CB10 Core Blower
DEMMLER Core Blowers all sizes
REDFORD Core Blowers all sizes
SIMPSON No. 1 Muller Model UD
SIMPSON #1½ UD
CLEARFIELD 404 Muller
SIMPSON #1—open gear
PANGBORN Table Cleaning Machine Model LG6 with Aux. Tables 24″ and Dust Collector
INGERSOLL RAND Air Compressor 100 hp. Pin Push-up machines
Dust Collectors—Many Sizes
WHITING Coal Pulverizers Model 30 and 30A
FISHER Aluminum Melting Furnace 300# Motorized Nose Pour, Gas Fired
INDUSTRIAL BRIDGE Cranes Motorized 1 ton Capacity 26′ Span
INGERSOLL RAND Cupola Blower Centrifugal 5200 CFM, 20 oz. with 40 Hp. Motor
BONDACTOR Model 1000L
Charging Cranes Monorail Type
TABOR Cut Off Saws
R-C Blower 18 x 54—7100 CFM 24 oz.
ROTOBLAST Model 14 GK w/dust collector
TESSMER Sprue Cutters
Ladles . . . All sizes open and enclosed gear
Steel Flasks Many Sizes
Air Hoists 500 lb. to 4000 lb.
Core Ovens, Drawer and Batch

B & P TRACTOR TYPE SLINGER
MANY MORE ITEMS AVAILABLE
WE SOLICIT YOUR INQUIRIES
WE BUY . . . SELL . . . TRADE
C. GREENE EQUIPMENT CORPORATION
4914 WEST 24th STREET
CHICAGO, ILLINOIS
LAFAYETTE 11322

FOR SALE

Schneible Wet Dust Collector, Size #58, Serial 52-2107Y with 20 Hp Allis Chalmers Tebb Motor, Controls and Miscellaneous Piping.

CLAYTON-SHERMAN ABRASIVES CO.
3896 LONYO AVE. DETROIT 10, MICH.
PHONE: LUZON 2-7200

FOR SALE

One Series 550 Reda Reverberatory furnace. Equipped for burning gas, oil, or a combination of both. Motor driven tilt, Spare linings and baffles. Used for less than a dozen heats on gray iron. $2200 complete. WASHINGTON STOVE WORKS, Everett, Washington.

FOR SALE OR TRADE

B & P Motive Jr. Sandslinger—19″ head, 4″ Tip, two speed. Complete with extra head. Offer?

PEK MACHINERY COMPANY
P.O. BOX 4146 BERGEN ST. STATION
JERSEY CITY, NEW JERSEY
PHONE: HE 2-4262

• FOR SALE

FOR SALE

B & P model 6024, 6000# hydraulic rollover draw machine complete and in excellent shape. 24" draw, 64" daylight, straight-in conveyor, 90° rollout conveyor.

B & P Rotomold, four roller conveyor station, pneumatically operated, 18' dia. indexing table, capacity 6000# per station, complete and in excellent condition.

Both may be seen in operation.

BOX 787, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

FOR SALE

27" x 36" American Wheelabrator, Serial Number A63376. Address: Weldon F. Stump, 4835 Crestridge, Toledo 13, Ohio.

• FOR SALE

WHITING CUPOLA

One #5, complete with motorized skip charger, 40 HP Spencer blower, Foxboro balancing instrument, spare 40 HP blower motor, spare 5 HP skip motor and miscellaneous cupola materials. Excellent condition.

PROPHETSTOWN DIVISION
BUFFALO-ECLIPSE CORPORATION
P. O. BOX 4 PROPHETSTOWN, ILLINOIS
ATTENTION: R. G. ROWLAND

FOR SALE

Shell Core Machine—MCM—7 Shalco. 1 yr. old.
3 Tumbling Mills 36" x 72"
Cupola Blower 15 H.P.
Cupola Blower 20 H.P.
Wheelabrator Baghouse. Nearly New.

ANAHEIM FOUNDRY COMPANY
125 W. COMMERCIAL ST.
ANAHEIM, CALIFORNIA
PHONE: LAMBERT 6-5566

FOR SALE

One Used #3 Unit Drive Simpson Muller. Good condition. Address: Box 788, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOR SALE

FOR SALE

One "San-Bio" Core Blowing Machine
Model #40-P1-LPP
18" x 24" Table Size
LIKE NEW CONDITION

BEAVER VALLEY ALLOY FOUNDRY CO.
MONACA, PENNSYLVANIA

ELECTRIC ARC FURNACE

Lectromelt "More Rapid" Electric Arc Furnace. 2 ton capacity. Top charge. Swing hood. With transformers and controls. Late model. Or will lease furnace and property.

MELTING CORP. OF AMERICA
OSTEND & RIDGELY STS. BALTIMORE, MD.
LEXINGTON 9-1980

FOR SALE

Beardsley & Piper Mulbaro—Model 3½
Beardsley & Piper Screenarator—Model M

WESTERN PIPE & STEEL, INC.
2001 AUBURN LUBBOCK, TEXAS

G-U-A-R-A-N-T-E-E-D
SAND BLAST EQUIPMENT
SELL BUY TRADE
TERMS AVAILABLE
Designers and Erectors of Specialized Blast Equipment

14' Wheelabrator Table Blast Model 4 with 4-66" Spin Tables like new. 30% off list price	
6' Wheelabrator Table Blast	$3500.00
4' Wheelabrator Table Room	3000.00
4' Wheelabrator Table Blast	2000.00
48 x 48 Wheelabrator Tumblast	3000.00
42 x 48 Wheelabrator Tumblast	2000.00
36 x 42 Wheelabrator Tumblast	1500.00
27 x 36 Wheelabrator	2750.00
27 x 36 Wheelabrator like new	4000.00
6' Pangborn Swing Table like new	6000.00
6' Pangborn Table Blast	3500.00
Pangborn GF2 Air bbl	450.00
Pangborn 53 EN-2 Hand Cabinet	325.00
Pangborn Auto Peening Cabinet	1100.00
Rumelin 8 x 8 Room	1000.00
Pressure Tanks, all types	$150.00 up
Vapor Blast Cabinets	400.00
Vapor Blast Automatic Table	3000.00

All types and sizes of Hand Cabinets, Dust Collectors, Pressure Tanks, Rooms, Horizontal or Vertical Tumbling Barrels and additional Sand Blast Equipment too numerous to mention.

$100,000 worth of Wheelabrator and Pangborn Spare Parts Priced 25% to 50% Less List.

DIAMOND SAND BLAST EQUIPMENT CO.
5654 W. Jefferson Ave.
DETROIT 9, MICHIGAN
VI-3-6750

HELP WANTED

FOUNDRY ENGINEER

To work with customers in developing Casting Techniques in Non-ferrous Metal Alloys.

Must have experience in pattern requirements including methods of gating, risers, venting and coring. Experience in sand preparation, centrifugal and permanent mold pouring and thorough knowledge of degassing, skimming, temperature control and alloying required.

Will work closely with sales personnel.

Position in rapidly growing company provides a bright future for the right man. Salary open.

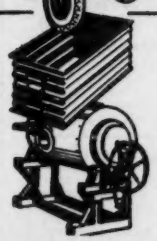
PLEASE SEND RESUME, IN CONFIDENCE, TO:
MR. HERMAN E. BERSTLER, MGR. OF PERSONNEL

The Beryllium Corporation

P. O. Box 1462, Reading, Pa.

EUCLID FOUNDRY & MACHINE EQUIPMENT CO.

14919 SARANAC ROAD CLEVELAND 10, OHIO



CLEANING EQUIPMENT
1—72" Swingout table
1—96" Swingout table
3—6 cu. ft. Continuous Tumblast
1—42" x 48", 17½ cu. ft. Tumblast with loader
1—36" x 42", 11½ cu. ft. Tumblast
1—6' Table Airblast w/six aux. tables
1—5' Table Airblast w/six aux. tables
1—6' Table Pangborn LE

AUTOMATIC MOLDING MACHINES
2—TDS-4 Taccone 24" x 24"

ELECTRIC FURNACES
1—3000 lb. Heroult Side Charge
1—500 lb. Lectromelt

MULLERS
Simpsons #1, 1½, 2, 3, unit drive
Clearfield #404, 610

LADLES-WHITING
4—25 Tons 2—15 Tons 2—10 Tons
3—3 ton Bottom Pour

CORE OVEN
1—Di-Electric Model M800-A
Thermonic, 30 KW

SANDSLINGERS
1—B-P 19" head stationary, double belt
1—B-P 19" stationary, riddle type

ASK FOR OUR COMPLETE LISTING—CALL GLENVILLE 1-1222

. . . . a trademark to remember . . . . a name to trust . . . . .

FOUNDRY ENGINEERING SERVICE

FOUNDRY EQUIPMENT BY FOUNDRYMEN

HAMLIN-NAGEL, INCORPORATED

Box 192, EDWARDSVILLE, ILLINOIS, *In Metropolitan St. Louis*, PHONE 3864

SAND SLINGERS
B & P Tractor type, 6' jib, 4' ram arm, 18" head.
B & P Stationary Riddle Type 6' Jib, 4' Ram Arm, 19" Head.

MECHANIZED MOLDING SYSTEM
Jeffrey 16 station Overhead Sand System, includes sand storage, muller, mold conveyor, shakeout and sand return.

JOLT SQUEEZERS
Osborn 275J
International LJS 10"—12"
International PJS 16"
Tabor Top Squeeze 10"
SPO 110J—113J
Champion 10"
Milwaukee 104-5—10"—12"
SPO 2136

JOLT SQUEEZE PIN LIFT
Milwaukee 126 Portable 21 x 27 Table 8" Draw
Milwaukee 145 24 x 30 Table 8" Draw
Osborn 712 18 x 28 Table 6" Draw

International PK18 18" Sq. Cyl 8" Draw 24 x 36 Table

JOLT ROLLOVER DRAW
International "G" 30 x 12
International "F" 45 x 72 x 16" Draw
J&J 612, 25 x 30 x 8" Draw
J&J 815, 30 x 40 x 15" Draw
J&J 918 44 x 54 table, 18" Draw
Osborn 405 39 x 63 table
Osborn 242W
SPO 508, 28 x 30 x 9" Draw
Tabor 30 x 50 x 12" Draw Shockless

JOLT PIN LIFT
Davenport 34A, 36 x 46 x 12" Draw
J&J 1216S, 36 x 54 x 16" Draw
J&J 683, 24 x 30 x 6" Draw
Milwaukee 1536, 32 x 38 x 10" Draw
Osborn 558 20" x 24" x 5" Draw
SPO 3070

JOLT SQUEEZE ROLLOVER DRAW

SPO 9546, 30 x 40 Flask 11" Draw
SPO 920, 32 x 44 Flask 11" Draw
Osborn 332, 26 x 36 Flask 9" Draw

PLAIN JOLTERS
J&J 72 x 72
Tabor 48" x 60"

SAND MULLERS
Simpson Lab Muller
Simpson Portomuller
Simpson 1½ UD w/or w/o skip hoist
Simpson No. 1, Style "H"
Simpson #2 w/skip (open gear)
Simpson #2 UD w/aerator and skip hoist
Simpson #3UD auto-cycle, dust hood, etc.
B&P No. 3½ Mulbaro
B&P #60 w or w/o Multromatic
Clearfield 610
Clearfield 920 w/skip
Carver CO. Sandmixer 130# cap.

SAND CONDITIONERS
B&P Screenarators, M. L.
50" Molders Friend
Royer NDP, Royer NC2, Royer JR
American Sand Cutter, various sizes
B&P No. 60 Preparator
3 Newaygo Handy Sandys HS7GT
1 Reddy Sandy

SHAKEOUTS
Allis Chalmers 4 x 6
Simplicity 3 x 5
Newaygo Reddy Sandy
Allis Chalmers 8 x 10
Simplicity 4 x 6

CORE BLOWERS
Redford No. 1 and No. 2
Champion, CB15, CB18
Demmler No. 55, 1, 2K, 3E
Hansberg Shooter
Demmler 103EO w/feeder skip hoist, semi-auto cycle
Ross Vibra—Draws

CORE OVENS
Tower oven, various sizes
Batch type. Core & mold drying, various sizes
Porbeck 16-2B double and single end five drawer
Foundry Equipment, single end, 5 drawer

CUPOLAS
Whiting Nos. 0, 2½, 4, 5, 7, 9, 10
Cupola Blowers, various sizes
Modern swivel charger
Hauck cupola lighter
Series 1000 Bondactor
Cupoliner Model 1500

LADLES AND POURING DEVICES
Modern, Whiting, all sizes plus mixing ladle, electric tilt, cylindrical and tea pot lip pour

NON FERROUS FURNACES
#60 to #250 Crucible & Iron Pot Furnaces, stationary and tilt
Lindberg Fisher Electric Induction
Reda 1000# power tilt type reverberatory
Stroman 1200# Economelt gas fired
Stroman 1600#/hr. reverberatory, 1 station double chamber reverberatory
6000# Fisher Simplex reverberatory complete, gas fired
Lindberg Fisher NMP nose pour, 1000# capacity, gas fired

CLEANING EQUIPMENT

48 x 72 American Wheelabrator with skip and dust collector

American #2 Multi table
42 x 48 American Wheelabrator
36 x 42 American Wheelabrator with skip & dust collector
27 x 36 American Wheelabrator with skip & dust collector
20 x 20 Air Blast Sly Barrel
No. 3 Pangborn continuous Wheelabrator with feeder & dust collector
36 x 72 Sly Tumbling Barrel, gearmotor drive

GRINDERS
Marschke 2 x 24
U. S. No. 64, variable speed
U. S. No. 65, variable speed 24"
Gardner 54" surface grinder
Mumert-Dixon Swing 15 HP 3 x 24"
Gardner 36" opposed wheel surface grinder

AIR COMPRESSORS
25 H.P. Air Cooled I.R.
100 HP XRB Ingersoll-Rand 2 stage, horizontal
175 HP XRE 2 stage, synchronous motor
30 HP Ingersoll-Rand horizontal
75 hp Ingersoll-Rand air cooled

AIR HOISTS
Ingersoll-Rand 700#, 1000#, 2000#, 4000#, and 10,000#
Curtis Air Cylinder Hoists

ELECTRIC HOISTS
P & H 500#, 1000#
Comet 500#
Cleveland 1000#
Yale 1000#, 6000#
Budgit 1000#

MATERIAL HANDLING EQUIPMENT
Hough Payloaders HA Models
Hyster Forklift 2000#
Clark Forklift 6000#
Towmotor Forklift 7000#
Baker Electric platform 6000#
D. C. Electric Clamshell 1⅛ Yard
Clamshell Buckets ¾ & 1 Yard
45" Bolted ECM Magnet
50" Bolted Ohio Magnet
55" Bolted Ohio Magnet
130' of 30" roller conveyor, 3½ rollers, 6" centers, 4" channels

2—3 ton Shepard Niles overhead cab operated cranes, 47' span with runway and motor and generator.

TESTING EQUIPMENT
Pittsburgh Brinell Hardness Tester
Sand Testing Equipment
Speedy Moisture Teller

MACHINE SHOP EQUIPMENT
Cincinnati #118 automatic mill
Betts 52" Vertical Boring Mill, 2 loading arms
Bridgeport vertical milling machine
Niles Radial Drill 13" x 5' arm
American Radial Drill 14" x 7' arm
Welding Positioner, 6000# Cap.
2 Foster turret lathes, serials 5U759 and 5U760, 21" swing, 2" spindle, 2 and 3 jaw chucks, cross-slide, coolant.

MISCELLANEOUS EQUIPMENT
Tessmer, Obermayer, Perkins ¾", 1½" blades, sprue cutters
Walker Turner all angle cutoff saw
C & P core knockout
Magnetic Pulleys
Steel Flasks
Slip Flasks, Jackets
500# Print-O-Matic Dial
American Rod Straightener Type F & H

PATTERNS FOR PRODUCT LINE
Approximately 50 matchplates and other patterns to produce a line of brass plumbing supplies, all jigs, fixtures, dies and special tooling, approximately $7000 *cost* stock finished parts on hand, National Sales distribution of products produced, list of customers and sales representatives.

WANTED! GOOD SURPLUS EQUIPMENT . . . . . .

One piece or a complete foundry—ferrous or non ferrous

THE ACME BARGAIN PAGE

AERATOR
NEWAYGO

BLOWERS
I.-R. 12900 cfm, 100 h.p. 220-440 V. 20 oz.
GE 10500 cfm., 20 oz., 85 h.p., 220 V.
GE 7500 cfm., 20 oz., 89.6 h.p., 220-440 V.
SPENCER 7350 cfm., 16 oz., 50 h.p.
GE Centrifugal 6200 cfm., 24 oz., 58 h.p.
6000 cfm. INGERSOLL-RAND 32 oz.
SPENCER 3500 cfm., 20 oz., 40 h.p.
SPENCER 2250 cfm., 16 oz., 15 h.p., 220
SPENCER 1350 cfm., 32 oz.
NORTH AMERICAN 1050 cfm. 16 oz.
NORTH AMERICAN 850 cfm.
500 cfm NORTH AMERICAN 12 oz.
McKee 200 cfm

BUCKET ELEVATOR
33' Newaygo 12" x 7" Buckets
28' Newaygo 12" x 7" Buckets

CLEANING EQUIPMENT
27" x 36" American w/skip
48" x 72" American w/skip
48" x 48" AMERICAN w/skip
6' Table PANGBORN
AMERICAN #2 Tablast 8-28" tables, late
PANGBORN GD1-Airblast Barrel

CONVEYOR
17' BARBER GREEN Bucket Conveyor

CONVEYORS, OSCILLATING
24" x 40' Ajax
SIMPLICITY 18" x 24'
SYNTRON 24" x 6'
AJAX 12" x 20'6"
36" x 11' Ajax
8" x 13' Ajax

CORE BLOWERS
CB15 55# cores, Universal blow plate
DEMMLER #4 up to 250# cores
DEMMLER #50
1—DEMMLER #55 w/vibratory hopper
2—DEMMLER #55 w/plain hopper
DEMMLER 7EO
DEMMLER 2K
FEDERAL "SAN-BLO" CB 40
INTERNATIONAL SB15H, up to 150# cores. Hydraulic clamp and draw
INTERNATIONAL SB 13, up to 60# cores
6—OSBORN 193 up to 50# cores
REDFORD #2 & #4

CORE GRINDERS
3—MILWAUKEE 70-9 & 70-12s

CORE OVENS
THERMONIC INDUCTION MODEL 1800A
2—Despatch ET. Drawer Type

CORE ROLLOVERS
INTERNATIONAL REDP Rollover 12" draw
SUTTER #500

CRANES
10 ton MILWAUKEE: 48' span, 220 V.

CUPOLA GUNS
1—Bondactor #1250 and 1000

CUTOFF SAWS
UNUSED DEWALT CUTOFF SAWS for ferrous or nonferrous metals, cutoff or as sprue cutters. Flush blade adapter takes up to 20" abrasive blade or saw. Power Hoist to arm. Chain & Sprocket cross feed for working on heavy cast iron 48" x 60" "T" slot table or off table cutting of large work. Motor swivels horizontal to vertical in yoke.

DUST COLLECTORS
PARSONS 40,000 cfm, cloth bag type

ELECTRIC MELTING FURNACES
1—DETROIT "LFA" 350# shell 13200 V.
1—DETROIT "LFC" 700# and 350# Tapered Shell 2300 V.

FURNACES
400# Fisher Motorized Tilt, Gas Fired
600# Fisher Stationary
600# Campbell Hausfeld Brass

GRINDERS, MISC.
U.S. #70 Comb. 20" disc & 20"x3"x1½" wh
GARDNER 18" single end disc.
GARDNER 26" D.E. Disc
Porter Cable BG 8 8" belt
72" Gardner Horizontal Disc
53" Hanchett Horizontal Disc

GRINDERS, SNAG
US #64 D.E. 20" x 3" x 10"
#5 Fox Sgl. Wh. 24" snag.
2—KLING H.D. 24" x 3" x 12" D.E.
KLING H.D. 20" x 2" x 7" D.E.
5—#6 FOX Single Wheel 24" Snag
U.S. #65 D.E. 30" x 3" x 12"

GRINDERS, SWING FRAME
FOX 24" x 3" x 12", 15 h.p.
MARSCHKE 24" x 3" x 12" 20 h.p., 220 V.
U. S. 24" x 3" x 12" 15 h.p., 220-440 V.
2—MARSCHKE 3 p.h., 12" wheel
1—B&D 7½ h.p.

HEAT TREATING FURNACES
G. E. Elevator Type 1950° Atmosphere Generator 65" x 16' car. Electric. Late
G. E. Elevator type 2150°—96" x 144" car atmosphere generator. Electric. Late
LINDBERG 1250° 48 x 60 Electric
3—ABBOTT 24" H x 22" Deep x 30" Wide, Gas Fired
HOLDEN #202 1850° Bright Hardening Annealing
25 KW Westinghouse 2000°

HOISTS
6000# Cleveland, w/monotractor travel
6000# Electrolift
6000# INGERSOLL-RAND Air w/powered trolley
4—2000# R & M
4—CLEVELAND 2000# Cab type hot metal carriers
1—500# Ingersoll-Rand LC-4

INDUCTION MELTING EQUIPMENT
30 KW Lepel Spark Gap
35 KW Ajax Tama Wyatt, 60 cycle induction holding furnaces
1000# Ajax Spare Melting Furnaces

LADLES
WHITING 16000# Crane
WHITING 8000# Crane
WHITING 5000# Crane
4000# Industrial Holding

MOLD BLOWER
TACONNE TD4 24" x 32" flask

MOLD CONVEYOR
366'—51—44" x 66" cars

MOLDING MACHINES
TACCONE High Speed molding machine for production pipe molds

JOLT SQUEEZE PIN LIFT
8—OSBORN 712 PJ 18" x 28" table
1—CHAMPION JSL10P 18" x 21" table 6" draw
8—MILWAUKEE 2646 Jolt Squeeze Strip rolloff—rolling molding machines 10" jolt cylinder; 1800# capacity, 26" Squeeze cylinder; 13" draw. Flask size 25¼" to 29" wide, 52" long. FACTORY REBUILT.
2—MILWAUKEE 165, 24" x 30", 8" draw
MILWAUKEE No. 145-2, 27" x 30" table

JOLT SQUEEZERS
2—CHAMPION JS10P 18" x 21" table
2—OSBORN 275PJ
2—MILWAUKEE 244 Jolt Squeeze car type head
MILWAUKEE 181-7, 24" x 36" table
276 SPO
4—113 PJ SPO
25—124 Milwaukee Portable Jolt Sq.
6—104 Milwaukee Portable Jolt Sq.
MILWAUKKE #162—1, 900 lbs cap.

JOLT ROLLOVER DRAWS
HERMAN 3000#
2—750# HERMAN 20" x 30" table
1—INTERNATIONAL RJ 20" x 12"
1—SPO 9032
3—SPO 506
1—SPO 506 SP
DAVENPORT #24—SA
2—INTERNATIONAL G
1—TABOR 30 x 52

JOLT SQUEEZE ROLLOVER DRAW
OSBORN 331-332-333
SPO 413D
INTERNATIONAL RES.

PLAIN JOLT
36" x 60" Herman

MULLERS and MIXERS
2—#2 Simpson UD
#40 B & P w/skip and water meter
1—#3 UD Simpson
1—930 Clearfield
CLEARFIELD #404
1—#2 SIMPSON OG
CLEARFIELD #610
CLEARFIELD—Laboratory

SAND CONDITIONERS
AMERICAN 51"
ROYER NDC—ND2
SCREENARATORS S-M-L

SAND SLINGERS & EQUIPMENT
3—19"—2 speed Stationary
2—14' Turntables
1—12' Turntable
4—7' Plate Feeders, 35 & 45 Tons

SAND SYSTEM EQUIPMENT
33' Newaygo Bucket Elevator 12" x 7"
28' Newaygo Bucket Elevator 12" x 7"
4—7' B&P Plate Feeders, 35 & 45 Tons
2—18" x 52' Magnetic Belt

SAWS, BAND
30" LAIDLAW, Metal Cutting hydraulic

SHAKEOUTS
6' x 10' SIMPLICITY, 8om—11, Spring Mounted

3' x 10' SIMPLICITY
5 x 10 LINK-BELT
4 x 8 LINK-BELT
2' x 8' Double Deck

SHELL EQUIPMENT
SHELL PROCESS 20" x 30" pattern size w/shell blender and bonding press

SHOT BLAST
SLY #4, 20" x 30" w/dust collector

SPRUE CUTTERS
1—MILWAUKEE #85 TON
OBERMAYER 2 H.P.

STRAIGHTENING PRESS HYDRAULIC
225 ton Southwark
150 ton Farquhar "C" Frame
100 ton Elmes Hydraulic
100 tons Hannifin Hydraulic
60 ton Lempco 4 post
60 ton Farquhar "C" Frame
25 ton Fox
25 ton Dennison

TESTING EQUIPMENT
ARLIN Automatic Rockwell, continuous
COLEMAN 55 Spectrophotometer
GOGAN Model 1414-2V

TUMBLING BARRELS
ROTO-FINISH Model DW 45-36
1—ROYERSFORD, 42" x 72", chain drive
SLY, 24" x 48"; 3 H.P.
SLY, 30" x 60" Duplex

WOODWORKING—PATTERNSHOP
OLIVER #290 Dbl Arbor, Tilto-Arbor Saw
1—OLIVER 182D, 15" Disc Sanders
CRESCENT 24" planer
6", 8", 12" and 30" Jointers

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ACME EQUIPMENT CO., INC.

We will buy for cash a single piece of equipment or your entire plant

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MONA

AAA BEST BUYS - SAVE NOW!

PARTIAL LISTING OF EQUIPMENT NOW AVAILABLE — INQUIRIES INVITED

CUPOLA BLOWERS

MODEL	C F M	PRESSURE	HP
INGERSOLL RAND			
FS-337	3000	20 oz.	25
FS-365	4500	16 oz.	30
FS-355	6000	16 oz.	40
FS-397	10,300	20 oz.	75
FS-377	10,500	20 oz.	85
FS-565	14,100	40 oz.	200
ROOTS CONNERSVILLE			
RCR	1040	20 oz.	10
RCS	9075	32 oz.	100
SPENCER TURBO			
2025H	1850	32 oz.	25
Cont.	7500	48 oz.	150

2 PANGBORNS LK 6' Dia. Table Room Rotoblast, Max. height of work 36", max. weight on table 5000#. Table speed 2.4 RPM. Pitless type. New 1952. Serial #6LY-5110.

SAND MULLERS

MODEL	PAN DIA.	CAPACITY
CLEARFIELD		
404	4'	400#
610	6'	1500#

MODEL	CAPACITY	AIR COOLED
BEARDSLEY & PIPER		
30	4 cu. ft.	Yes
30	4 cu. ft.	No
60	12 cu. ft.	Yes
60	12 cu. ft.	No
70	15 cu. ft.	No
70	15 cu. ft.	Yes
80	20 cu. ft.	Yes

ALL CAN BE EQUIPPED WITH DUST HOODS, SKIP HOIST LOADERS, MULTRAMATIC CONTROLS, ETC.

2—B&P #3½ Mulbaros.
1—SIMPSON Porto-Muller.

MODEL	PAN. DIA.	CAPACITY	DRIVE
SIMPSON			
0	3'	175#	Sep.
1-H	4'	500#	UD
1½	4'-6"	700#	UD
2	6'	1500#	UD
2	6'	1500#	Encld.
3	5'	3000#	UD
3	8'	3000#	Encld.
3½	9'-3"	5000#	UD

ALL CAN BE EQUIPPED WITH NATL. ENG. STRAIGHT LIFT SKIP HOIST BUCKET LOADERS.

MODEL	PAN DIA.	CAPACITY
LANCASTER		
EA4	50"	9 cu. ft.
EBG-4	59"	9 cu. ft.

JOLT SQUEEZE PIN LIFT MACHINES

MODEL	TABLE SIZE	DRAW	DIA.	CAP.
PKL-12	18" x 24"	5⅛"	12"	600#
PKL-14	20" x 28"	5⅛"	14"	1000#
PK-16	20" x 30"	8"	16"	1700#
MILWAUKEE				
125	21" x 27"	8"	12"	1200#
145	24" x 30"	8"	14"	1700#
195	28" x 39"	10"	19"	3000#
196	16¾" x 39"	10"	19"	3000#
244	22" x 32"	12"	24"	3000#
245	35¼" x 42"	12"	24"	5900#
246	23¼" x 42"	12"	24"	5900#
OSBORN				
710-PJ	16" x 25"	6"	10"	500#
712-PJ	18" x 28"	6"	12"	750#
714-PJ	20" x 31"	7"	14"	1000#
716-PJ	22" x 34"	7"	16"	1250#
SPO				
2114-P	20" x 27"	4"	11"	600#
2136	21" x 30"	6"	13"	800#
2146	23" x 31"	6"	14"	1000#

JOLT SQUEEZE ROLLOVER DRAW

MODEL	TABLE SIZE	DRAW	CYL.	CAP.
MILWAUKEE				
167	32" x 33"	12"	16"	1000#
OSBORN				
332	26" x 36"	9"	16"	750#
333	32" x 45"	11"	19"	1400#
OSBORN ROTOLIFT				
3131	22" x 26"	11½"	13"	750#
SPO				
413-C	24" x 25"	10"	13"	600#
917-A	26" x 36"	9"	17"	750#

WHITING 10-TON HYDRO-ARC FURNACE
10' dia. shell, 6'-8" inside depth, 1" steel plate. Cradle tilt, manual & motorized, 9" dia. electrodes. Capacity—18 to 23 tons cupola malleable iron per hour. Holding capacity—16 tons normal, max. 21 tons.
1—ALLIS CHALMERS 2000 KVA Furnace Transformer, 12,000 volt primary, OIWC motor operated tap changer. Entire unit new 1952.

OSCILLATING CONVEYORS

AJAX ENGINEERING (Lo-Veyor)

MODEL	SIZE	CAPACITY in T P H
LC 18-6-24	18" W x 24' L	50
LC 24-6-7	24" W x 7' L	70
LC 24-6-21 FA	24" W x 21' L	70
LC 36-6-9 DA	36" W x 9' L	100
LC 36-6-14 DA	36" W x 14' L	100
HEWITT-ROBINS		
VC-6	24" W x 120' L	55
VF-3	30" W x 5' L	12
LINK-BELT		
Flexmount	8" W x 70' L	15
SIMPLICITY ENGINEERING		
OA-10-JA	24" W x 13' L	150
OA-10-JA	24" W x 11' L	150
OA-10-JA2	30" W x 7' L	150
OA-10-JA	30" W x 13' L	100
OA-10-JA	36" W x 6' L	150
OA-10-A	36" W x 10' L	200
OA-10-A	36" W x 16' L	200
OA-10-A	36" W x 25' L	600

SANDSLINGERS

B&P Stationary, Model "DB," 5' jib arm, 4' ram, 19" head, 5" cup, 2-speed, 20/13 HP. Raising & lowering arms or fixed.
B&P Stationary, Model "DB," 8' jib arm, 4' ram, 19" head, 4" tip, 20/16 HP. Raising & lowering arms or fixed.
B&P "Motive Jr.," 11' jib arm, 4' ram, 16" head, 4" cup, R & L arms, 2-speed, 20/13 HP.
B&P "Motive," 15' jib arm, 9' ram, 2-speed, 25/16 HP. With Raising & Lowering Arm.

HANDY SANDY'S

NEWAYGO SHS-4-G Super Handy Sandys, Single Hopper, 15 cu. ft. capacity, 4' receiving hopper, air gates, 21' center elevator.
NEWAYGO SHS4-GT Super Handy Sandy, Twin Hopper, 25 cu. ft. capacity, 4' receiving hopper, 21' center elevator.
NATIONAL ENGINEERING Moulders Helper, Twin Hopper, 3000# capacity, each air operated gates.

JOLT PIN LIFT MACHINES

MODEL	TABLE SIZE	DRAW	CAP.
DAVENPORT			
34 A-JS	36" x 46"	12"	2500#
INTERNATIONAL			
JDP 1200x8	24" x 26"	8"	1200#
JDP 3000x10	48" x 48"	10"	3000#
JL	32" x 52"	12"	2000#
JOHNSTON & JENNINGS			
68-8P	25" x 30"	8"	600#
812-S	30" x 38"	12"	1600#
MILWAUKEE			
1030	28" x 34"	8"	1000#
1536	32" x 38"	10"	1500#
2036	32" x 38"	10"	2000#
2542	38" x 42"	12"	3000#
3548-6	44" x 46"	12"	3500#
OSBORN			
540	32" x 52"	12"	2000#
560	32" x 45"	12"	2500#
SPO			
3070	26" x 35"	10"	1500#

JOLT ROLLOVER PATTERN DRAW

MODEL	TABLE SIZE	DRAW	CAP.
DAVENPORT			
24 SA	24" x 38"	12"	1000#
28 SA	28" x 40"	12"	1500#
34 A	34" x 58"	15"	2500#
48 A	48" x 82"	24"	6000#

1—INTERNATIONAL Model "AN," Air Clamp, Air Turnover, Air Draw-Molding Machine, 4500# capacity. Flask—40" width by open ends. Draw 20". New 1952. Used six months.

MODEL	TABLE SIZE	DRAW	CAP.
JOHNSTON & JENNINGS			
612	24" x 30"	12"	600#
815	30" x 40"	15"	1200#
918	44" x 54"	20"	2000#
920-RC	44" x 54"	20"	2000#
1020-RC	50" x 60"	20"	3000#
OSBORN			
242-W	29" x 42"	12" to 19"	1500#
244	35" x 52"	16" to 25"	3000#
405	57" x 64"	26"	3000#
442	21" x 31"	10"	600#
601	24" x 30"	10"	900#
602	30" x 36"	12"	1200#
643	35" x 50"	20"	2000#
SPO			
505	18" x 23"	6⅛"	400#
506	24" x 25"	10"	600#
TABOR			
22"	22" x 32"	10"	600#
22"	22" x 42"	10"	600#
30"	30" x 40"	12"	1000#
40"	40" x 60"	15"	3000#

DEPENDABLE SERVICE • QUALITY EQUIPMENT • GUARANTEED SAVINGS

AAA

10900 CEDAR ROAD

FLASH! DON'T MISS THIS TREMENDOUS AAA LIQUIDATION OF THE FOUNDRY FACILITIES OF ONE OF AMERICA'S GREATEST FARM IMPLEMENT MFGRS. AT 3RD AVENUE IN ROCK ISLAND, ILLINOIS

CONVEYORS

LINK-BELT Apron Conveyor, 30" wide x 45' centers, "No-Leak" type. This unit has approx. 5' on the horizontal, 20' on the 30° incline plus 20' on the horizontal.
STANDARD steel slat mold conveyor, slats —24" x 6", total length unit—60', rising approx. 10' at discharge. Complete w/all structural supports, 7½ HP motor & gear reducer. New 1956.
LINK-BELT oscillating conveyor, 36" wide x 180' long, positive action, complete w/three (3) drive units. This unit can be split into three (3) units—36" x 60' x 8" deep. Serial #K-5519. Each unit complete w/7½ HP TECBB motor. This conveyor is bolted in 20' sections of pan.
310' Roller Conveyor, 16" wide, 3½" dia. rolls, 6" centers, 4" angle, 1" hex shaft.
125' Roller Conveyor, 24" wide, 2½" dia. rolls, 6" centers, 4" channel, 11/16" hex shaft.
112' Roller Conveyor, 24" wide 3½" dia. rolls, 6" centers, 4" channel, 11/16" hex shaft.
100' approx. 28" wide x 3½" dia. rolls 6" centers—1" hex shaft.

CORE BLOWERS

INTERNATIONAL core blower, model #8B-15-H. Complete w/sand reservoir. Serial #60896-1.
DEMMLER core blower, model #1EOS. Serial #3676, automatic, new 1956. Complete w/air clamping, Demmler vibrating sand feeder. Capacity cores to 10#, draw cylinder 11" dia. 8" stroke. Little use—Guaranteed Excellent Condition.
DEMMLER core blower, model #55, serial #2359. Capacity—cores up to 3½#. Complete w/air clamps & sand magazine.

CORE OVENS

DESPATCH OVEN CO. slat conveyor type oven, continuous, 5' wide opening 18" height of opening, length 18' x 67" high plus an additional 5 to 6' for combustion chambers & burners. Total length of unit —25 to 28'. Oven is recirculating, automatic, complete w/air controls, gas fired, primary voltage—440, control voltage—110. Temperature 450° F. Serial #33412.
(2) FOUNDRY EQUIPMENT CO. "COLEMAN" core ovens, 3-compartment. Each compartment inside dimensions—77" wide x 12' long x 78" high. Each compartment overall dimensions—8' wide x 13' long x 7'-4" high plus an additional 5' for recirculating on combustion chambers. Each compartment has it's own gas burner equipment & recirculating equipment.

DESPATCH continuous type core oven, approx. 46' long x 20' wide x 10' high, with approx. 250' of Jarvis B. Webb #678 chain conveyor. Complete w/trolleys on 2' centers. Load bars on 8' centers w/additional trolleys. Load bars are complete w/50 carriers—4' x 5' x 6', each carrier having 8 shelves. This unit complete w/gas burners & all controls.

CUPOLAS

(2) MODERN cupolas, size #8, complete w/Modern swivel type skip hoist charger.

CUPOLA BLOWERS

INGERSOLL RAND cupola blower, type FS-347, 5200 CFM, 1¼ # pressure, 3500 RPM 40 HP TEFCBB motor, 220/440 V.

SALE STARTS TODAY

New 1952. Serial #S-347Y2. Complete w/Foxboro controls.
INGERSOLL RAND cupola blower, type FS-554 8700 CFM, 2# pressure, 100 HP TEFCBB motor 220/440 V. New 1951. Serial #5554B2. Complete w/Foxboro controls.

CLEANING ROOM EQUIPMENT

PANGBORN multi-table tableblast, model #9LG. 9' dia. main table. Complete w/6 36" dia. auxiliary tables. Serial #9LG-14-475.

CRANE

MORGAN 5 ton crane—220 V DC. 68' span —A frames 16' high 240' runway. Cab operated.
DING 45" magnet—220 V DC.
HAYWARD electric clamshell model #3-S-1½ yd.

DUST COLLECTORS

AMERICAN #27 roto-clone, type W-Arr. C.
AMERICAN #30 roto-clone, type W-Arr. C.
AMERICAN #16 roto-clone, type D.
2 AMERICAN #20 roto-clone, type D.
AMERICAN #10 roto-clone, type D.

MULLERS

H&P
BEARDSLEY & PIPER #70 Speedmullor, air cooled, complete with (1) air operated bond hopper, two (2) air operated batch hoppers, with manual compensator starter, water meter timer, 100 HP motor, 220/440 V. The manual compensator starter on this unit is 100 HP 440 V. Ser. #70-133-484.
BEARDSLEY & PIPER #80 Speedmullor, batch capacity—24 cu. ft., 8'-6" dia. of pan, equipped w/air operated batch hopper, water meter dust hood, 15 HP Clarage cooling fan, air cooled. 125 HP motor. Ser. #80-34.
SIMPSON
Simpson #3 unit drive sand muller, complete w/#3 skip hoist loader, air operated discharge door. Complete with all starter controls dust hood, water meter, etc. Ser. #55112.

SAND SYSTEM

MOLDING HOPPERS
Sand System consisting of one (1) 24" x 190' long distributing belt conveyor with eighteen (18) moulders hoppers, approx. 1000 to 1500# cap. Moulders hoppers have hand operated gates, hand plowoffs on the belt conveyor.

SAND SLINGERS

BEARDSLEY & PIPER model "DB" stationary sandslinger, 4' ramming arm, 19" head, 4" cup, 20 HP motor, single speed, 6' jib arm. Ser. #200270373.

PLATE FEEDER

NEWAYGO 5-ton plate feeder, 5' dia. plate, complete w/5 HP motor, 220/440 V. With Palmer-Bee gear reducer.

WRITE P. O. BOX NO. 836 ROCK ISLAND, ILLINOIS FOR A COMPLETE BROCHURE PH. ROCK ISLAND 788-4309

THIS IS JUST A PART OF THE CREAM!

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"Built on a Foundation of Mutual Trust"

CLEVELAND 6, OHIO SW 1-3900

Universal* MACHINERY AND EQUIPMENT CO.

. . . large enough to serve you, small enough to know you.

1632 North Ninth Street
Reading, Pa., Franklin 3-5103

• AIR COMPRESSORS
25 hp INGERSOLL-RAND water cooled, horizontal
75 hp INGERSOLL-RAND water cooled, horizontal
100 hp WORTHINGTON air cooled, 2 stage

• BLOWERS
CENTRIFUGAL 5 Hp to 30 Hp
GE, WILBRAHAM—GREEN FISHER Positive Pressure & Cent., Cupola Blowers

• BLAST CLEANING EQUIPMENT

Over 80 rebuilt Wheelabrator units sold in less than two years.

15" Cont. WHEELABRATOR Tumblast
26" Cont. WHEELABRATOR Tumblast
15" x 20" WHEELABRATOR Tumblast
20" x 27" WHEELABRATOR Tumblast
27" x 36" WHEELABRATOR Tumblast
36" x 42" WHEELABRATOR Tumblast
48" x 42" WHEELABRATOR Tumblast
48" x 48" WHEELABRATOR Tumblast
48" x 72" WHEELABRATOR Tumblast
1-A WHEELABRATOR Multi-table
72" WHEELABRATOR Swing Table
No. 2 WHEELABRATOR Multi-table
WHEELABRATOR Pipe Cleaning Cabinet
WHEELABRATOR Sheet Cleaning Cabinet, handles up to 48" wide stock
PANGBORN 8' LF Table
PANGBORN Air Blast Room 6' x 8'
6' LK PANGBORN Table Room
6' LG PANGBORN Table
DUST COLLECTORS AND SKIP LOADERS AVAILABLE FOR ALL MACHINES

Just received from Gov't storage 48" x 42" & 27" x 36" WHEELABRATORS with skip loaders & dust collectors, at least 50% savings. LIKE NEW . . . ACT QUICKLY

• CONVEYORS
CARRIER Oscillating, 18" W x 54' L
HEWITT-ROBINS Oscill. 18" W x 40' L
HEWITT-ROBINS Vibrating, 18" W x 10' L Model VC-1
LINK-BELT, Car type mold, 114 cars, 403' track, car size 18" x 42"
LINK-BELT Oscillating, 18" W x 13' L
SIMPLICITY 17" W x 11' L, Model OA-10-KA Feeder
SIMPLICITY 24" x 10' Feeder w/hopper, Model OA-10-JA2
Roller Conveyor—Ask for List

• CORE BLOWERS
DEMMLER #1, #2, #2A, #3K
INTERNATIONAL SB-13
OSBORN #91, #192, #91-10
RANDALL MODEL "A" Bench Type
SAN-BLO #40-P-1, 40# core
TACCONE #4D, 10" Draw Stroke Cyl.

• DUST COLLECTORS
COMPLETE STOCK both Bag & Wet Types, 1000 to 17000 CFM

• FURNACES
DIRECT ARC MELTING
250 lb. LECTROMELT, Side Charge
500 lb. LECTROMELT, 200 KVA trans.
1000 lb. SWINDELL
2000 lb. HEROULT
2000 lb. Swindell, 3/60 1000 KVA
1½ Ton HEROULT
11' Top Charge Furnace
INDIRECT ARC MELTING
10# DETROIT
350# DETROIT LFA
750# DETROIT LFY, Conical Shell
1000# DETROIT AA
3000# DETROIT C, 500 KVA
INDUCTION MELTING & HEATING
30 KW, ECCO Hi-freq. Vacuum Melting
30 KW, LEPEL, water cooled spark gap
35 KVA, AJAX Spark Gap, High Freq. steel
GAS & OIL FIRED
400# & 600# FISHERS, MNP
1000# HAUSFELD Hand Tilt, Oil fired, alum or magnesium
1—#900 JC STROMAN, gas, Like new
6000# STROMAN, gas fired
20 Gas & Oil Fired Furnaces
HEAT TREATING
4' x 4' x 10' Gas Fired Annealing
9' x 12' Car Type, gas/oil
210 KW LINDBERG conveyor box type
7' Rotary G.E. 200 K.W. 1950° F
36" x 36" West. Pit Type Electric
10" x 12" x 24" LINDBERG, 2500° F. Hyd
42" x 73' G.E. Roller Hearth, 1950° F.
48 x 120, 48 x 144 gas fired
Large Stock Gas Fired Box Heat Treating Furnaces

• PIT TYPE ANNEALING
42 x 96, 42 x 120 recirculating gas fired

• GRINDERS
DOUBLE END
3 Hp HISEY WOLF 3/60/220
5 Hp U.S. Model 64, 3/60/220
7½ Hp U.S. Model 66, 3/60/440
10 Hp STANDARD 3/60/440
15 Hp MARSCHKE 220 volt
25 Hp KLING 3" dia. shaft
PEDESTAL
3 Hp CLEVELAND 3/60/440
5 Hp CINCINNATI 2/60/440
SWING FRAME
7½ Hp MUMMERT-DIXON 2/60/220-440
10 Hp SAFETY 24" x 3" wheel
15 Hp MARSCHKE 3/60/220-440
15 Hp MUMMERT-DIXON

• LADLES
BOTTOM POUR
MODERN, 49" x 49"
MODERN Crane Type, 55" H x 50" top
MODERN Crane Type, 60" H x 60" top
LIP POUR
WHITING 52" x 52" top dia. geared
CYLINDRICAL
WHITING, 26" L x 25" dia., 1100# iron
WHITING, 19" L x 22" dia., 600# iron
WHITING, 38" L x 28" dia., 2200# iron

• MATERIALS HANDLING
BYERS Mobile Crane, BUDA Engine, 50' Boom, 5 ton w/magnet & bucket
HOUGH PAYLOADER, Model HA, 1000# cap., hyd. lift, mech. dump

• MOLDING MACHINES
JOLT ROLLOVER PATTERN DRAW
DAVENPORT #406A, 40" x 60" table, 3000#
HERMAN 10,000# 48" x 109" table
HERMAN 6000#, 42" x 78"
HERMAN 7500#, 40" x 50" table
HERMAN 3000#, 30" x 66" table
HERMAN 3000#, 32" x 70", 15" cyl. series charging conveyor type
HERMAN 1500#, 30" x 48" table
INTERNATIONAL 27" x 18", Type F, 22" x 64" table
INTERNATIONAL 31" x 16", Type F, 24" x 78" table
INTERNATIONAL 30" x 12", Type G, 28" x 35" table
INTERNATIONAL 13" x 17" table
INTERNATIONAL 43" x 16", type F, 42" x 72" table
OSBORN #602, 36" x 26", 900#
OSBORN #405, 3000#, flask 64" x 57"
TABOR 40" x 60", 1500 & 3000#
TABOR 22" x 42" pattern draw shockless, portable 600#
TABOR 20" x 30" w/air clamps, 1000#
TABOR 14" x 16" Rockover 150#
TABOR 40" x 50" table, 3000# capacity
PLAIN JOLT
INTERNATIONAL, 3' x 4' Table, 12" cylinder
TABOR 3' x 4' table
JOLT PIN LIFT
HERMAN #1317, 22" x 30" table
SPO #305, 750 lb. 20" x 27" table
TABOR 20" x 24" table, 600#
JOLT SQUEEZE PIN LIFT
INTERNATIONAL PKL, 20" x 28" table, 14" sq. 5½" draw
INTERNATIONAL PKL, 18" x 24" table, 12" sq., 5½" draw, stat.
MILWAUKEE #163, 15" x 24" table, 11" sq., 1500#
MILWAUKEE #165, 24" x 30" table, 16" sq., 1700#
NICHOLLS 18-44, 6½" draw
OSBORN, #712J, #712PJ, 18" x 28" table, 12" sq., 6" draw, stat. & port.
OSBORN #716 PJ, 22" x 34" table 16" sq., 8" draw
SPO #2114P, 21" x 27" table, 600#
SPO #2116, 21" x 27" table, 11" sq., 6" draw
JOLT SQUEEZERS
INTERNATIONAL #12 LJS, 16" x 20"
SPO #13PJ, 18½" x 26" table
OSBORN #275J, 16" x 20" table, 400#
SPO #110J, 17" x 20" table, 400#
TABOR Squeeze-in Head, 16" x 19" table
TABOR Yoke Type, 18" x 26" table

• MULLERS AND MIXERS
B&P #30 Speedmuller w/skip, 3 cu. ft.
B&P #40 Speedmuller w/skip, 5 cu. ft.
B&P Conventional, SIMPSON type, 87½" Dia., arranged for cooling
B & P #70 Speedmuller, 15 cu. ft. w/cooling.
CLEARFIELD #920, 9' dia., 30 cu. ft.
CLEARFIELD #610, 6' dia., 14 cu. ft.
SIMPSON, #0, U.D., 3' Dia.
SIMPSON #1, Sep. Dr., 4' dia., 4 cu. ft.
SIMPSON, #1½, U.D., 4'6" dia., 6 cu. ft.
SIMPSON #1½, Sep. Dr., 4'6" dia., 6 cu. ft.
SIMPSON #2, enc. gear or open gear, 6' dia., 14 cu. ft.
SIMPSON #3, 8' Dia. Sep. Dr., 30 cu. ft.
WHIRLMIX, 31" dia., 200 to 300 lb. sand

• OVENS
COLEMAN, Gas, 2 Comp. and 5 drawers, O.D. 22' x 12' x 10'
GIRDLER Thermex Dielectric Core Oven, 15KW w/36" W mesh belt
THERMONIC Dielectric Core Oven, 18 KW, w/40" wide mesh belt

• PRESSES
40 Ton FERRACUTE Sprue Cutter 1½" stroke
125 ton R.D. WOOD Down acting, 9" stroke
NIAGARA No. 82 Punch Press

• SAND CONDITIONING
B&P Nite-Gang
B&P Screenarator, Model "M"
LINK-BELT Revivifier
ROYER, NC-2, 10-15 tons/hr, 1¼ Hp
ROYER, PREPARATOR, Comb., Model NDC, 25 ton/hr scrap removal 8' x 8' hopper
ROYER, NDP, 15-25 tons/hr, 2 Hp
ROYER, "NRP," 40-60 tons/hr, 5 Hp.

Sand Handling System
NATIONAL ENGINEERING UNIT
Inc.: #1½ Simpson U.D. Muller w/water meter, National Screen Master Preparator, skip bucket loaders, 20"x20' belt conveyor, "Elevayor", 2 Moulder's Helpers (4 stations)—1957 unit LIKE NEW — LOW LOW PRICE!

• SAND SLINGERS
B&P Stationary, Single Speed
B&P Tractor Type 16" Head
B&P Tractor Type 19" Head
B & P Motive Speed slinger, 2 speed, 22" head, 5" tip

• SHAKEOUTS
2' x 10' HEWITT-ROBINS
3' x 10' SIMPLICITY
4' x 5' SIMPLICITY
4' x 6' SIMPLICITY
4' x 8' SIMPLICITY
5' x 6' HEWITT-ROBINS
5' x 8' HEWITT-ROBINS

• TESTING MACHINES
3000 Kg Gogan Brinell Testers
60,000 lb. Tensile Tester

• TRANSFORMERS (Furnace)
100 KVA KUHLMAN 13,200, 1/60
250 KVA WESTINGHOUSE 6600, 3/60
300 KVA WAGNER 4600, 1/60
500 KVA KUHLMAN 13,200, 1/60
800 KVA PENNA, 23,000, 3/60
1000 KVA WESTINGHOUSE 23,000, 3/60
1000 KVA G.E. 13,200, 3/60
2000 KVA WESTINGHOUSE 13,200, 3/60
5000 KVA WESTINGHOUSE 2300, 3/60
7500 KVA PENNA, 13,200, 3/60

• TUMBLING BARRELS
SLY 68" x 32" round
SLY 48" x 36" round

• MISCELLANEOUS
BLASTCRETE Model PM-1 Cupola Gun
FLASKS, CORE PLATES, All Sizes
CLIMAX Model 2-A Wire Straightener
62" Magnet
MOULDER'S Hoppers, Various Sizes
TABOR 10 HP Cut-off Saw

* Your *DEPENDABLE* Foundry Equipment Dealer

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Main 1-8260

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BPA NBP

Produce BETTER CASTINGS

with *Laboratory Tested*

FOUNDRY MATERIALS

SAND

Portage (Wis.) Silica
Century Molding
*Ottawa Blackhawk Silica
Muskegon Lake Sand
Tenn. & Ind. Molding
Utica Crude Silica
Green Lake & St. Marie Shell
*Zircon Sand and Flour
Berlin Core Sand
Red Flint Annealing & Packing
New Jersey Molding
Gallia Red Molding
Albany Molding
Olivine Sand and Flour
Gopher State Silica

BONDING CLAYS

*Volclay, MX-80 (Granular)
*and Panther Creek Bentonite
*Goose Lake Fire Clay
*Grundite Bonding Clay
Goose Lake Castables

ABRASIVES

*Tru-Steel Steel Shot
Globite Steel Shot and Grit
*Mallebrasive Shot and Grit
*Certified Shot and Grit
*Blackhawk Sand Blast Sand
*Super-Titan Nozzles

REFRACTORIES & MISC.

Cupola Gun Mixes
Firegan Ganister
*Microsil Silica Flour
Fluxing Limestone
*Five Star Wood Flour
*Sultron Foundry Flux
Iron Oxide-Fluorspar
Cellulose Flour

***Whse. Stocks carried**

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INCORPORATED

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MILWAUKEE 3, WISCONSIN
BRoadway 6-0140

ST. PAUL 5
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Tel. Midway 9-6312

MUSKEGON
608 Lake Drive
Tel. SH. 4-1589

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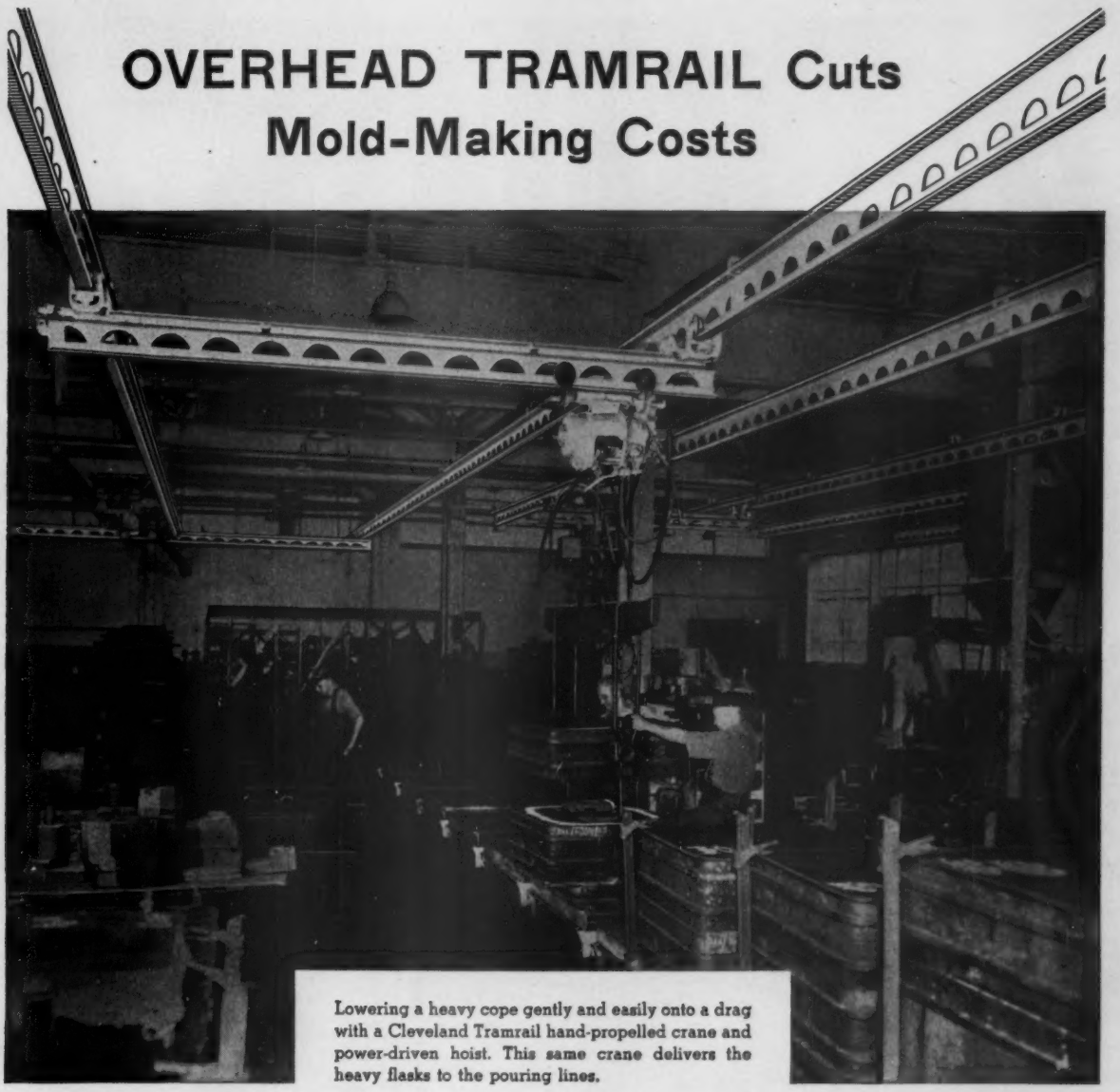
OVERHEAD TRAMRAIL Cuts Mold-Making Costs



Lowering a heavy cope gently and easily onto a drag with a Cleveland Tramrail hand-propelled crane and power-driven hoist. This same crane delivers the heavy flasks to the pouring lines.

A tremendous amount of handling is required to make a mold. In fact, the cost of a mold is largely that for moving sand, pattern, and flask to the molding floor, handling of these items during mold-making, and conveying of completed mold to the pouring floor. Any improvements that you make in reducing the time required for handling these materials will cut your production costs.

Cleveland Tramrail equipment has proven highly successful in slashing handling time for mold-making in foundries of every type. It operates fast or slow as the work dictates. Raw materials can be handled speedily. Delicate molds can be hoisted slowly and gently and moved with nearly vibration-free travel over smooth overhead Tramrail tracks.

Hundreds of foundries throughout the United States and Canada are making large savings with Cleveland Tramrail in every department. Why not invite a Cleveland Tramrail engineer to discuss ways of cutting costs in your foundry.

Write for free copy of Engineering and Data Booklet No. 2008. Packed with valuable information.

CLEVELAND TRAMRAIL

Overhead Materials Handling Equipment

CLEVELAND TRAMRAIL DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 3841 E. 286 ST. • WICKLIFFE, OHIO

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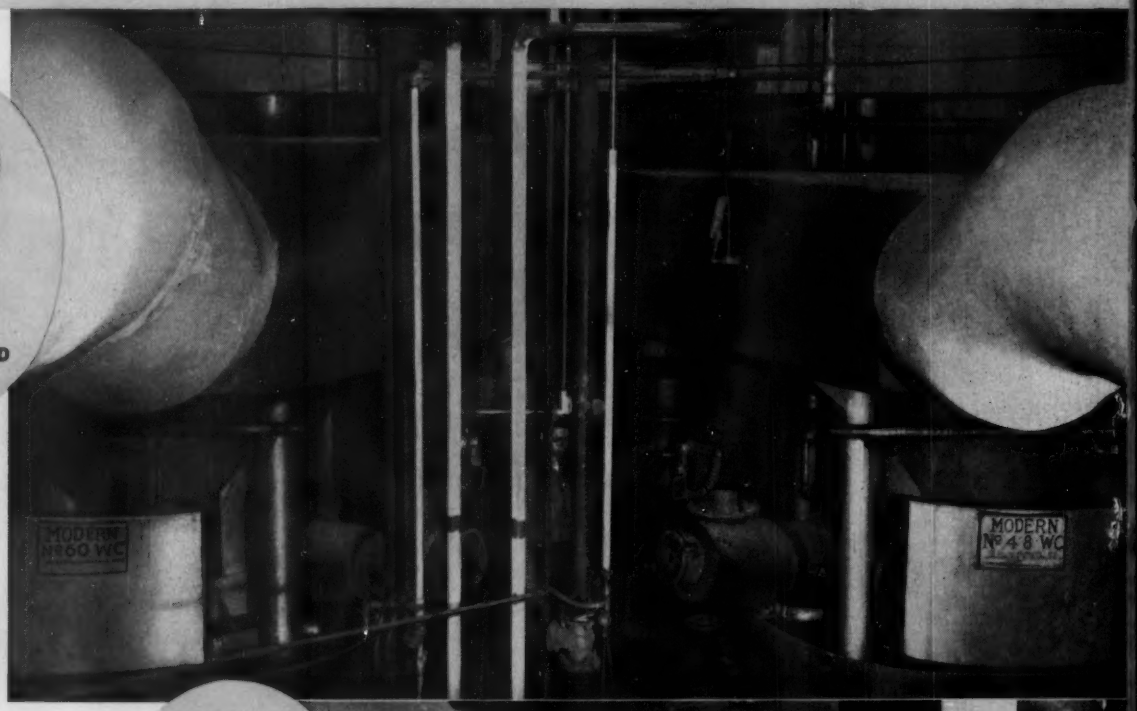
MORE ABOUT WATER-COOLED CUPOLA OPERATION



2
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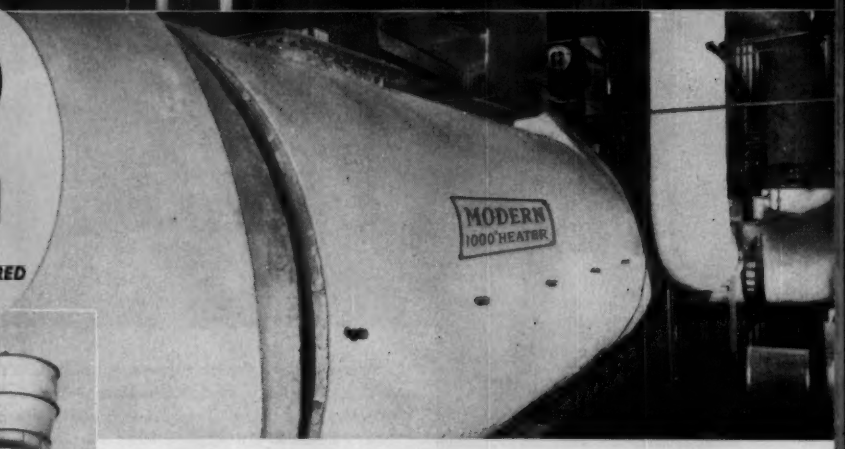

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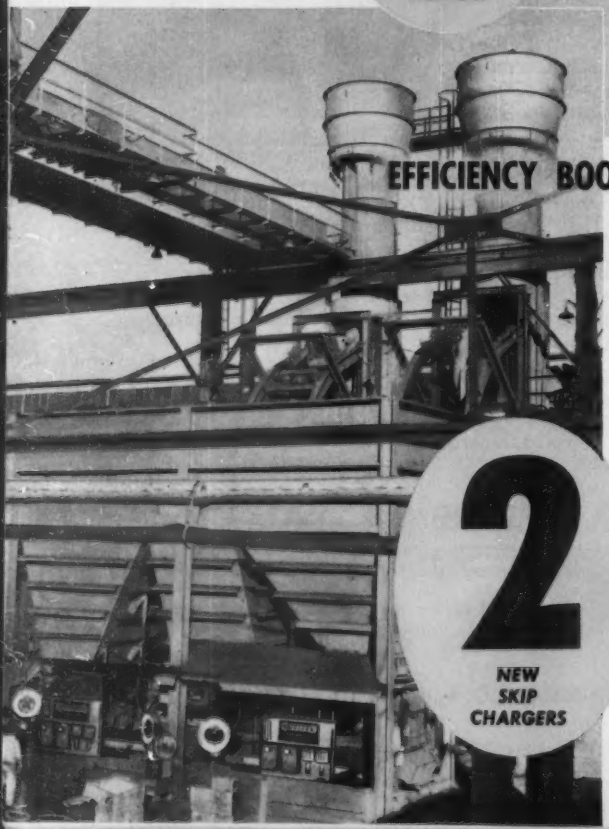

2
NEW SKIP CHARGERS

EFFICIENCY BOOSTED BY 1000° F. RECIRCULATORY HEATERS

At General Electric Company, Elmira, New York, new, water-cooled cupolas are in operation. Three, former, separate, melting areas have been consolidated into one-central-location. NOW; all the metal, of varying analyses, is supplied by two, MODERN, water-cooled cupolas. Melting progresses against the water-cooled shell. Labor is minimized by two, MODERN, skip chargers -- complete with small-cone, orange-peel buckets, coke bins, and flux bins. All are served by a magnet crane. All charging and melting supervision is consolidated at one, automated center. We'd like to plan with you, too. Bulletin 149-A will be mailed on request.

MODERN

MODERN EQUIPMENT COMPANY
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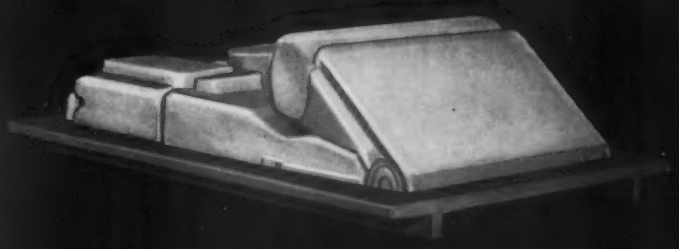
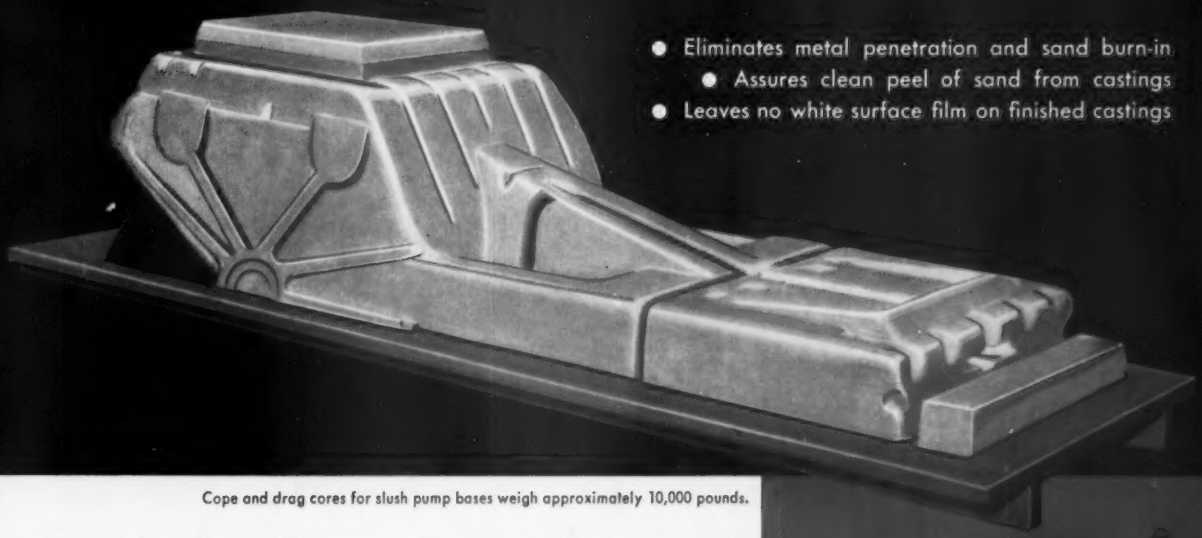
STEVENS GRAPH-Z CORE WASH

CUTS CLEANING ROOM COSTS AT GARDNER-DENVER



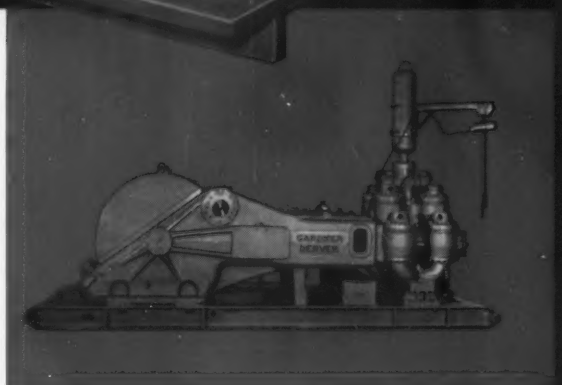


- Eliminates metal penetration and sand burn-in
- Assures clean peel of sand from castings
- Leaves no white surface film on finished castings

Cope and drag cores for slush pump bases weigh approximately 10,000 pounds.

The Gardner-Denver Company, world-renowned manufacturer of oil field equipment, depends on Stevens Graph-Z Core Wash to produce smooth, clean castings for its famous deep-drilling slush pumps. The result: better castings that require fewer cleaning-room operations prior to final finishing!

Write today for information on Stevens complete line of core washes and other foundry products. Or, contact your Stevens representative . . . he'll show you how you, too, can produce better, cleaner castings and reduce overall foundry costs!



Gardner-Denver Model GXP Deep-drilling Slush Pump.

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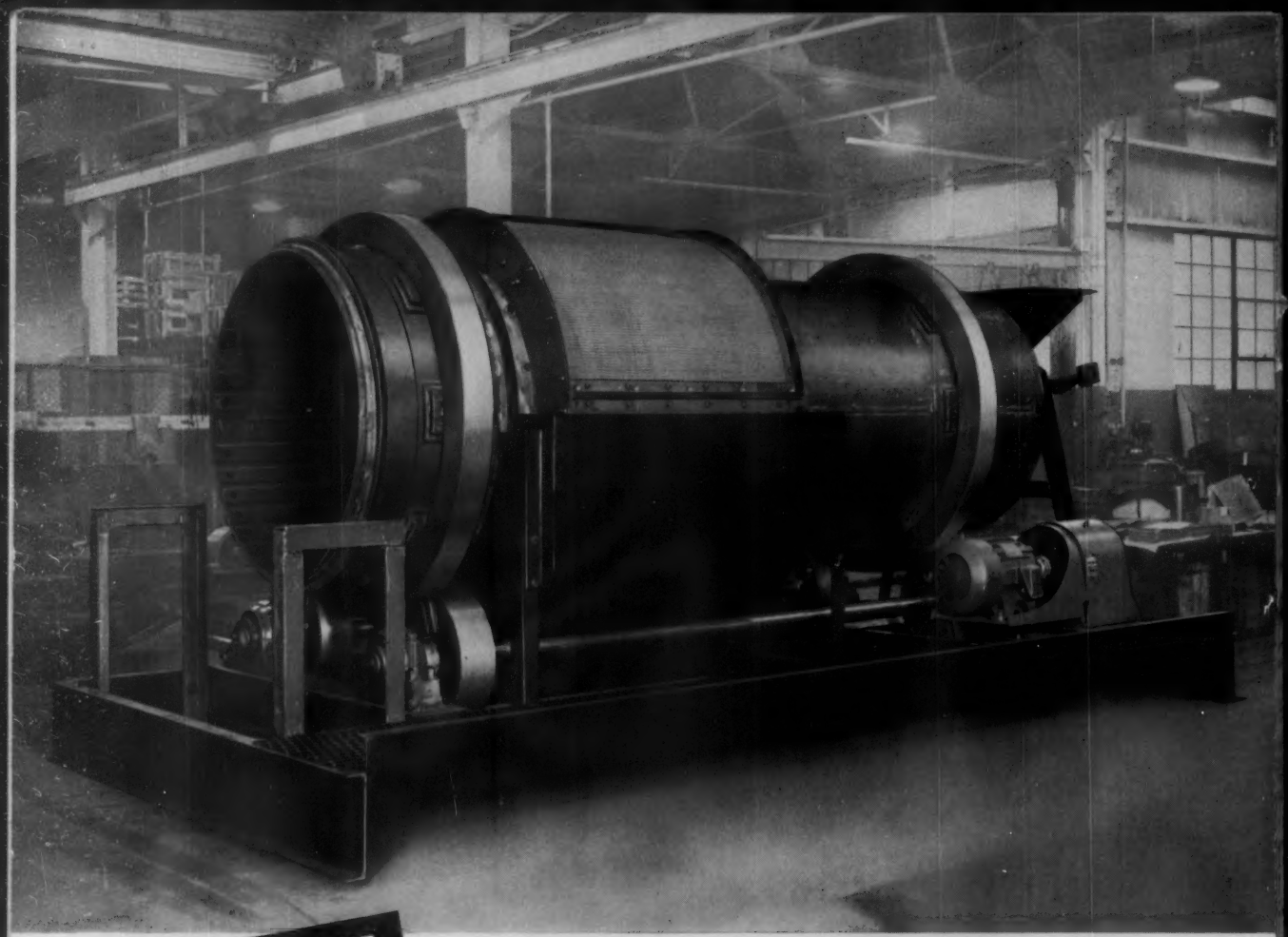

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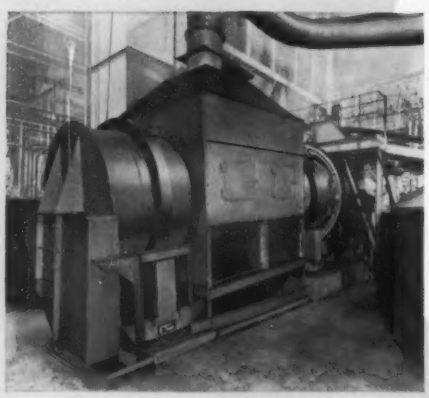
CLEVELAND 5, OHIO

ROTARY SCREENS

for breaking lumps, scalping off sprues, core butts and tailings, cooling and other services.



Wide range of types and sizes from 36″ to 84″ in diameter, capacities from 25 to 350 tons per hour.

Many Bartlett-Snow cooling screens reduce sand temperatures to 125°F. or less. All screens are designed specially for foundry service assuring long, efficient, trouble-free and maintenance-free operation. Furnished complete with feed and discharge facilities, if desired.

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